Concrete

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A Successful Reinforced Concrete Base for Street Railway Tracks

Roadbed Design Based on Research Analysis and Thorough Tests—Rails Anchored to Concrete Foundation by Resilient Anchorages—Cushion Reduces Impact—Provision for Temperature Changes—First Cost and Upkeep

By I. O. MALL
Supt. of Roadway Department, New Orleans Public Service, Inc.

THE many and varied types of roadbeds for street railway tracks constitute ample evidence that few types have been found satisfactory. In the design and construction of about four miles of single track in Canal Street, New Orleans, we feel that we have a roadbed that meets all the requirements of structural strength, resilience, low maintenance cost, provision for expansion and contraction, ease of renewal of rails, and freedom from noise.

Development of Street Railway Track Support

The development of roadbeds for street railway tracks has, for the most part, taken the form of "cut-and-try" methods, based on the best judgment of designers and builders of roadbeds. Numerous efforts have been made to overcome the inherent defects of paved track construction, chiefly through the substitution of steel ties for wood ties and the consequent strengthening of rail fastenings.

There is little evidence that any of the various types of track construction were based on research analysis. On the contrary, the designs were based largely on judgment and were built with the idea that, at the very least, they would be better than the type they replaced and that it would be worth while to see how they acted in service.

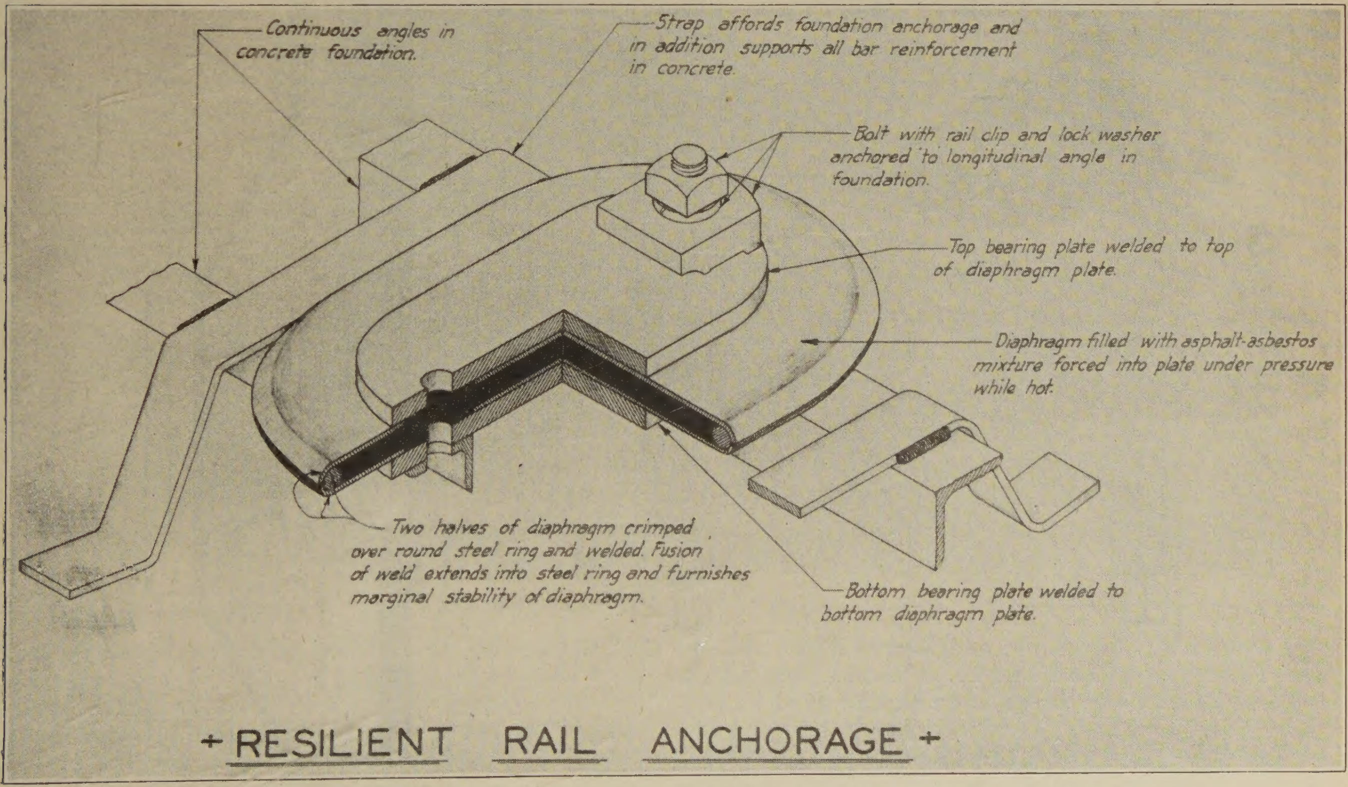

Continuous angles in concrete foundation.
Strap affords foundation anchorage and in addition supports all bar reinforcement in concrete.
Bolt with rail clip and lock washer anchored to longitudinal angle in foundation.
Top bearing plate welded to top of diaphragm plate.
Diaphragm filled with asphalt-asbestos mixture forced into plate under pressure while hot.
Two halves of diaphragm crimped over round steel ring and welded. Fusion of weld extends into steel ring and furnishes marginal stability of diaphragm.
Bottom bearing plate welded to bottom diaphragm plate.
+ RESILIENT RAIL ANCHORAGE +

Figure 1. An asphalt-filled resilient rail anchorage diaphragm

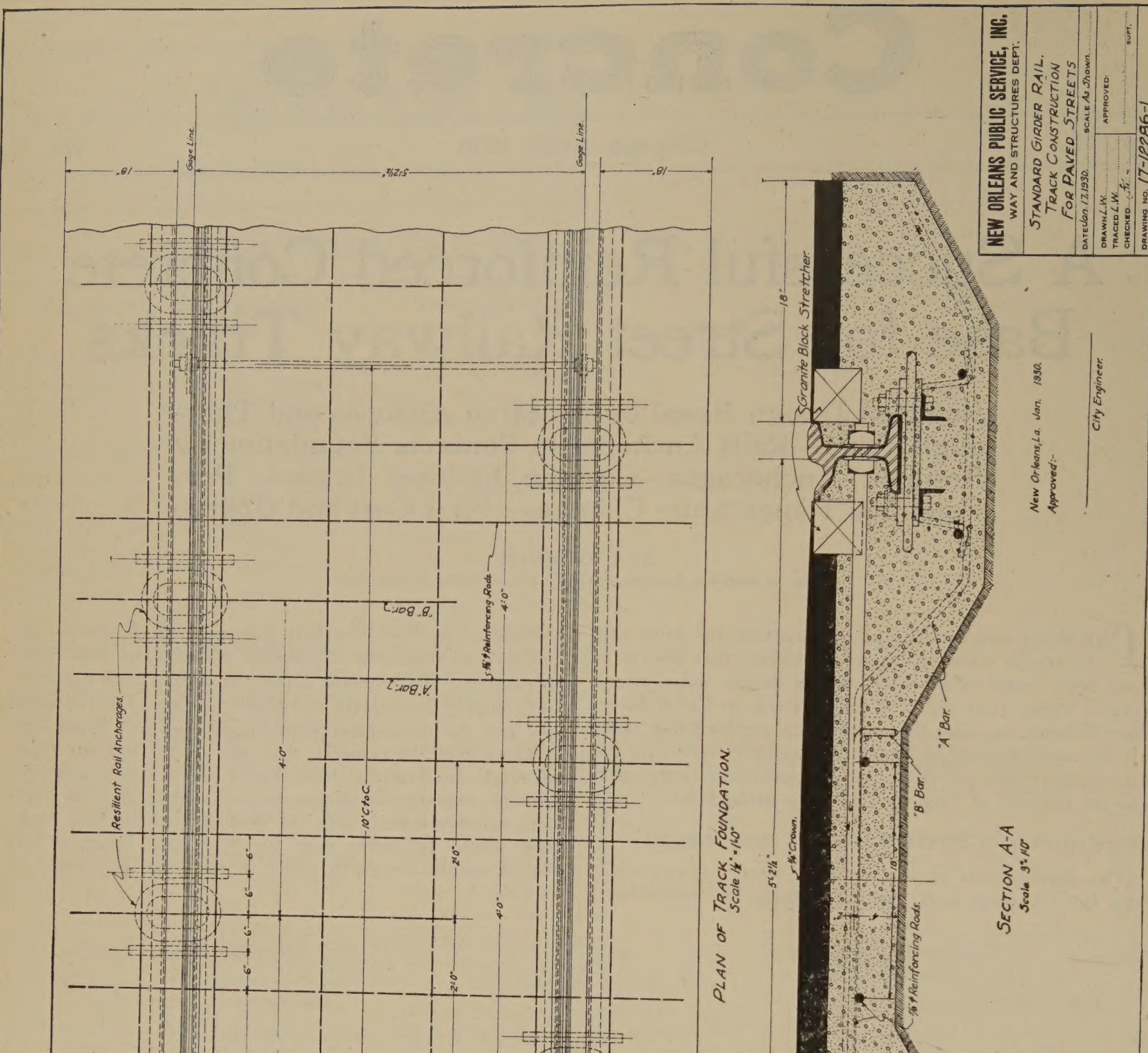


Figure 2. Plan and cross section of reinforced concrete street railway track support

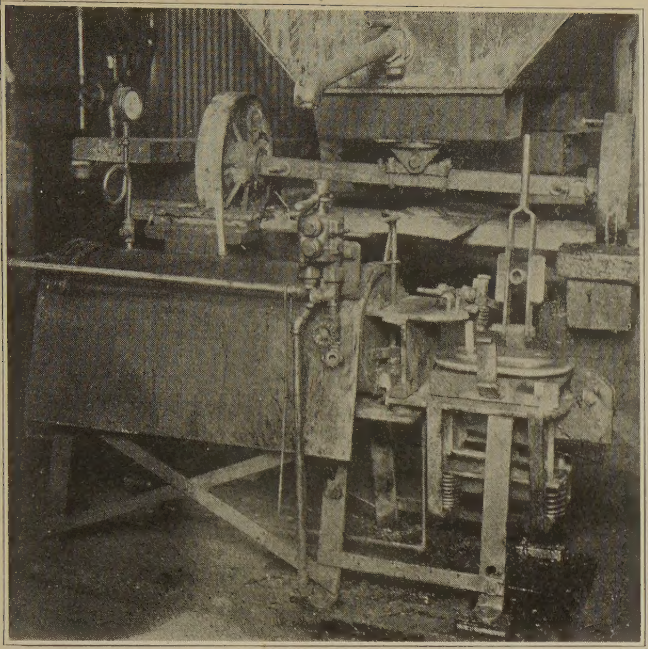


Figure 3. Filling the steel plate rail anchorage diaphragm with hot asphalt to make it resilient

New Orleans Design Based on Careful Analysis and Tests

The methods followed in the development of the reinforced concrete track support in Canal Street is a combination of careful structural design supported by thorough tests under conditions simulating actual service. The engineers of the Roadway department of New Orleans Public Service, Inc., started out under the assumption that the design and application of a reinforced concrete track support is susceptible to engineering analysis and that such a roadway slab, to be economically satisfactory, must combine the materials of construction in a manner that will stand the test of actual service.

With these thoughts in mind, the subject was approached as a definite problem in engineering design and construction. This analysis included not only the structural design of the reinforced concrete slab, but also the requirements of the rail anchorage and means of preventing the transmission of shock from the rail to the concrete slab.

Description of Roadbed Slab

The roadbed structure consists primarily of a reinforced concrete foundation to which the rails are anchored by means of resilient rail anchorages. The slab is shown both in cross-section and in plan in Figure 2, the street railway company's Drawing No. 17-12286-1, on the preceding page. As will be seen from this drawing, the foundation slab is shaped so as to form a continuous girder beneath each rail and parallel to the rail. The reinforcement in each of these girders consists of two $5/8$-in. straight and deformed bars. The transverse reinforcement, extending the full width of the slab and passing under each rail, is also of $5/8$-in. round deformed bars. An excellent illustration of the reinforcing bars in place, ready for the slab to be concreted, may be seen in Figure 5. Two continuous longitudinal angles are embedded in the concrete beneath and parallel to each rail. The rail anchorage units are fastened to these angles, which are held in parallel alignment by deformed straps welded to the angles at the points of contact. These same deformed straps support and carry the entire system of bar reinforcement.

From the cross-section of the railway track structure it will be seen that the reinforced concrete foundation slab and the pavement concrete form a monolithic unit, providing the maximum of strength with a minimum of material. Observe the tie rods illustrated in Figure 5. These tie rods, which extend from rail to rail, are covered with an asphaltic material to prevent their bonding to the concrete. This in turn prevents interference with the resilient action of the rail itself.

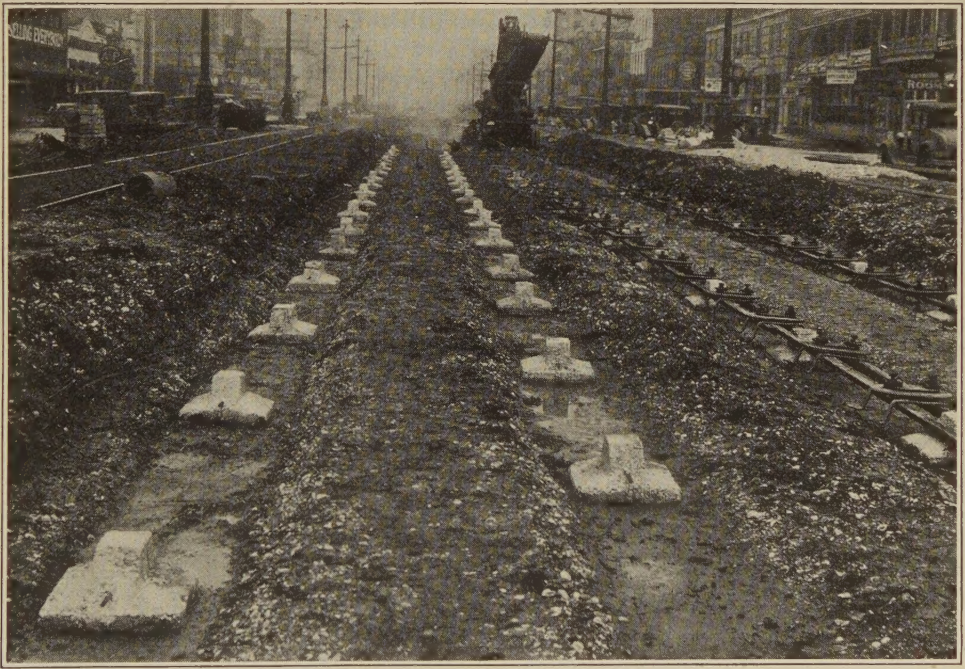


Figure 4. Subgrade and concrete pedestals ready for laying the rails and their supports

The design provides a cushion between the rails and the pavement and also between the rails and the reinforced concrete base itself. The cushion between the rail and the pavement along its side is accomplished by the application of a ¼-in. coat of asphalt to the rail before the concrete is placed. This coating prevents the entry of water and the possibility of corrosion. Transmission of shock from the rail to the concrete base is prevented first of all by placing a ¼-in. thickness of elastite immediately under the base of the rail, this strip being held in place by special wire clips. With this strip of elastite on the base and with the ¼-in. coating of asphalt along the sides, no part of the rail comes into actual contact with the concrete.

The coating of asphalt along the sides of the rail serves as a vibration insulator and prevents water from entering between the pavement and the rail, as previously stated. The action of the rail under the effect of moving wheel loads is therefore independent of the concrete base and the surrounding pavement, and the rail is not completely restrained either laterally or vertically. With a uniformly controlled rail movement it becomes possible to separate the rail and the pavement with the assurance that watertight construction will be maintained, vibration is materially reduced, and there is very little noise from the operation of cars.

Further elimination of impact is obtained by means of a specially designed anchor plate or diaphragm. Nothing of this nature was available on the market, so that it became necessary to make a special design for the purpose. This anchor plate or diaphragm played so important a part in the success of the design, under actual service conditions, that a description of it will not be out of place.

The Resilient Anchor Plate or Diaphragm

It may be accepted as a foregone conclusion that this rail anchorage diaphragm was not designed on the basis of snap judgment. It was subjected to careful analysis and a long series of tests before the shop orders were placed for its manufacture in quantity.

The rail anchorage diaphragm is shown in detail in Figure 1, which consists of our Drawing No. 17-12294-1. As this detail clearly shows, the diaphragm consists of two oval shaped thin steel plates crimped on the outer edges over a round steel ring and welded at the periphery to form a closed container. The welding process fuses the edges of the plates together and the whole is fused to the steel ring, forming a very stable marginal periphery within the diaphragm. An oval shaped bearing plate is welded to both the top and the bottom diaphragm plates. These bearing plates are substantially smaller than the diaphragm plates and concentric therewith. The rail is held in place by rail clips, the anchorage bolts passing through the diaphragm and bearing against the embedded angles in the foundation. The inside of the diaphragm contains an asphalt-asbestos mixture forced into place under pressure and while hot.

The load from the rail is transmitted through the upper bearing plate to the top of the diaphragm. As the diaphragm plate flexes inward, a compression is built up in the confined asphalt-asbestos cushion and this pressure is resisted by the bottom bearing plate of the diaphragm, which in turn transmits the load to the foundation. When the load is relieved the residual compression in the elastite cushion, acting in conjunction with the resilient diaphragm plates, returns the upper bearing plate to its normal position. The asphalt-asbestos cushion serves a dual purpose in that it affords stability to the diaphragm and aids in dissipating the vibration absorbed from the rail.

From the fact that there is a strip of elastite ¼-in. thick between the rail and the anchorage diaphragm, and the further fact that there is resiliency in the diaphragm itself, it will be seen that movement in the rail anchorage occurs without mechanical wear. This feature assures uniform action throughout the life of the diaphragm. Attention is also invited to the lateral action of the diaphragm, which permits a lateral or tipping action of the rail. This allows the rail and wheel to make full contact under variable conditions of wear and improves the adhesion between the wheel and the rail.

These rail anchorages are spaced 4 ft. from center to center and are staggered with respect to those under the parallel rail.

Filling the Diaphragms with Asphalt

The filling of the diaphragms with asphalt was an interesting process in itself. The equipment employed is illustrated in Figure 3. One of the diaphragms may be seen in position, in the process of being filled. The supply of hot liquid asphalt was kept in the horizontal tank on the left and was forced from the tank and into the diaphragm by compressed air that entered the tank at the top.

Testing the Diaphragm

In devising the methods of testing the anchorage diaphragms we took account of the fact that the moving wheel load is essentially a moving impact load. We estimated this impact as the equivalent of a suddenly applied load of 10,000 lbs. Consequently we devised an arrangement whereby a test load of 10,000 lbs. was applied suddenly at intervals of 2 seconds. This test was kept up continuously for nearly 5½ months, making a total of more than six million successive load applications. We estimated that this was the equivalent of 75 years of service under actual operating conditions.

Under this load of 10,000 lbs., the diaphragm deflected only 0.025 of an inch. Thus the bending stresses set up in the plates are very small and the plates should have a long life. The asphalt-asbestos cushion is inert and confined, so that it cannot be dissipated. Properly protected from corrosion and electrolysis, the life expectancy of the anchorage diaphragm is certainly commensurate with the rest of the structure.

Provision for Temperature Changes

The steel bar reinforcement in the foundation is so distributed as to absorb the wheel load and temperature stresses developed in street service. Under the influence of temperature changes, the rail acts independently of the foundation, because of its complete separation from the pavement and the foundation by the resilient cushions of asphalt and elastite. Expansion due to a rise in temperature simply builds up compressive stresses in the rail. The rail fastening holds the rail in alignment, prevents buckling, and the compressive stress is absorbed in the rail itself. Contraction due to a fall in temperature builds up a tension in the rail which requires no assistance from the fastenings in holding the rail in proper alignment.

Expansion and contraction of the reinforced concrete foundation occur independently of the rail in accordance with the elastic properties of the unit. Steel and concrete have the same coefficient of expansion, but due to their unlike strength and elastic properties they cannot act together under the influence of temperature changes. Sufficient steel bar reinforcement is provided to prevent and control visible cracking and to take care of flexural stresses acting in conjunction with temperature stresses.

Use of Granite Block Along the Rails

Granite paving blocks are laid parallel to the rail and embedded in the freshly laid concrete. These blocks pro-

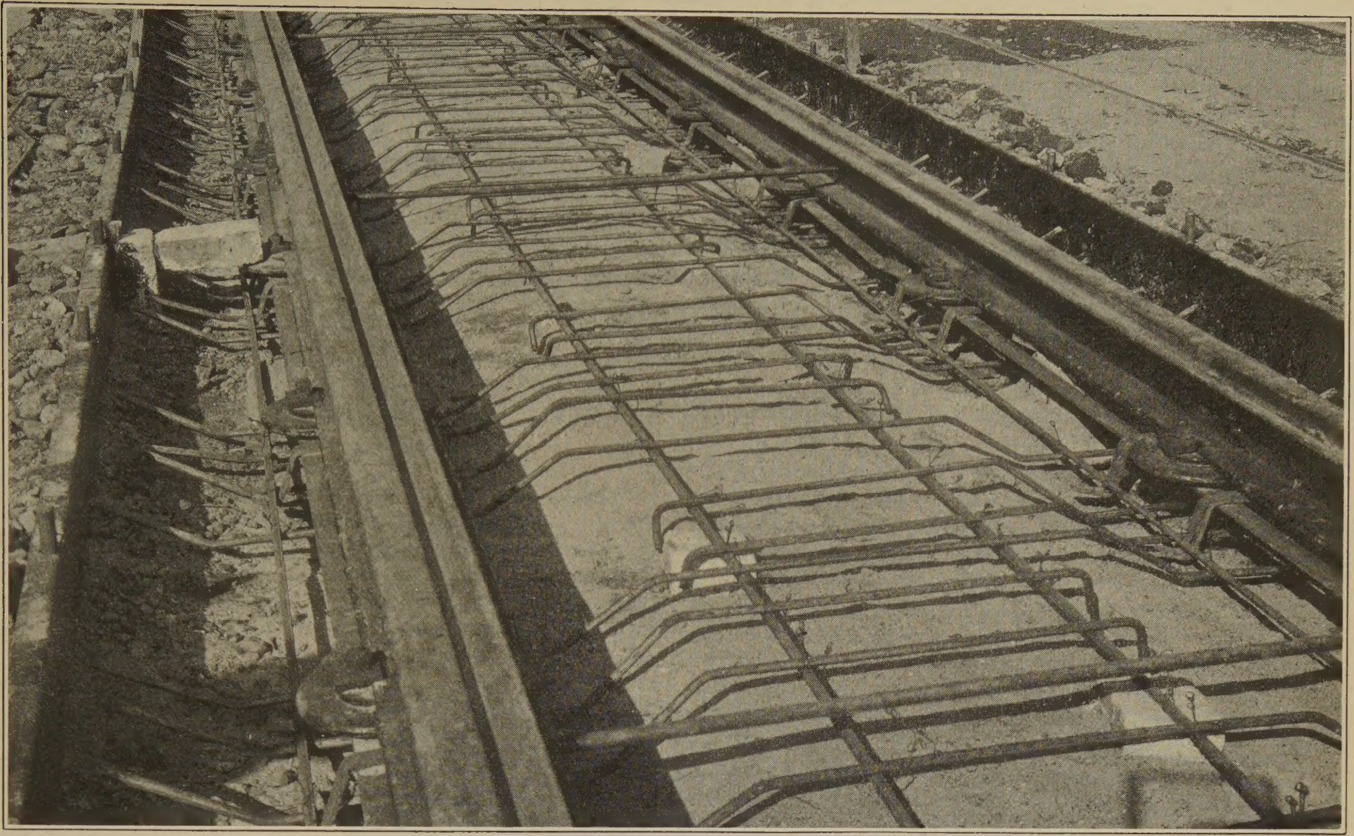


Figure 5. Ready for concreting the track base

vide lateral stability for the edges of pavement surface material, such as asphalt. The surface pavement may therefore be removed without disturbing the rest of the structure.

Rails May Be Renewed

Rails may be renewed by breaking out the granite blocks and a sufficient amount of concrete between the blocks and the rail to allow access to the clip fastenings. On the assumption that the resilient rail will ultimately fail, its replacement can be made without disturbing the foundation.

This track design is not a cheap construction as far as first cost is concerned. The track constructed in Canal Street, such as shown in Figure 1, cost about $75,000 per mile of single track. Other types of single track construction have been built for less money, and yet New Orleans Public Service, Inc., has in times past spent as much as $80,000 per mile per single track for a type of track support far inferior to this one.

It is on the low maintenance cost that the street railway company will receive its return. Careful study and analysis of the probable maintenance requirements on this type of construction indicated that there should be practically no maintenance at all. In fact, one of the underlying motives back of the development of this design was the desire to construct a track that would have long life and require no major maintenance. There is no reason to

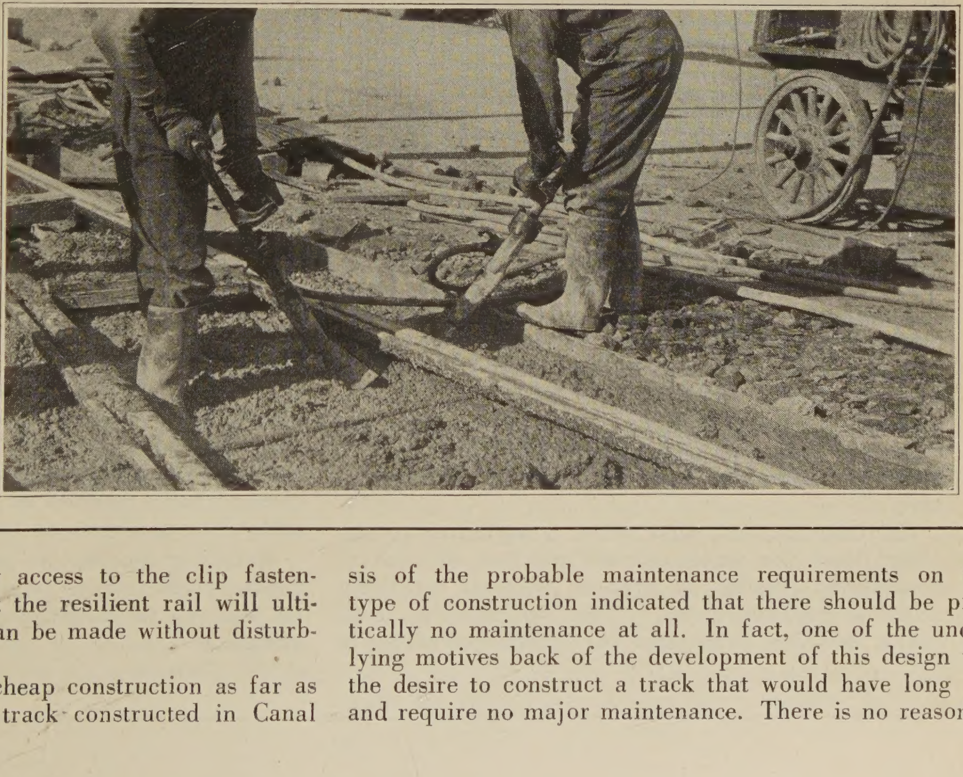


Figure 6. Air driven vibrators were effective in tamping the fresh concrete under the rails and rail fastenings

believe that the structure will not hold up as the analysis and the tests indicate that it should, in which event track maintenance will be confined to welding and grinding at the joints and to repairs of the asphalt pavement occasioned by vehicular traffic. While it is desirable from the standpoint of investment to keep the first cost as low as possible, this should not be done at the expense of subsequent maintenance and depreciation. We estimate that the average maintenance cost will not exceed $100 per mile per year throughout its whole life, and that an annual depreciation rate not greater than 3 per cent will cover renewals and replacement.

Construction of the Track

In preparing for the construction of this track work, we were compelled to take into consideration the fact that it was different from anything we had attempted before. Under the circumstances we had no construction crews who were familiar with this particular type of track base. Fearing that confusion might result because of this lack of familiarity we built a complete section of full size track on the floor in our general offices not far from Canal Street. The track section was explained to the construction crews who were brought to the office for instruction and practice, and each crew was then given several practice drills in assembling the work.

On the actual construction site the preliminary work is well illustrated by Figure 4, which shows the completed subgrade. Blocks or pedestals of concrete made especially for the purpose are in place to support the continuous longitudinal angles beneath the rails. At the right of the picture these angles may be seen in position, with the rail anchorage units and deformed straps fastened to them.

Figure 5 illustrates a later stage of construction, all fastenings and reinforcements being in place and side form planks set, ready for concreting the track base.

A good view of the placing of the concrete track base is shown in Figure 6. Air-driven vibrators are used for tamping. These tampers were especially effective in getting the concrete into the longitudinal trough beneath the rails, since under the influence of the vibratory action the fresh concrete settled definitely into place, filling all spaces underneath and around the angles, the rail fastenings and the rails.

Hudson Appointed Association District Engineer at New Orleans; Macatee to Richmond

William G. Hudson, who has for eight years represented the Portland Cement Association in the Shreveport territory, has been appointed district engineer at the New Orleans office of the association, located in the Hibernia Bank Building. The New Orleans district includes the states of Louisiana and Mississippi. The appointment was effective March 1st.

Mr. Hudson succeeds W. R. Macatee, who has been transferred to the Richmond office of the association as district engineer. Mr. Hudson has been actively identified with the development of the 3,000 mile highway construction program undertaken by the present state administration of Louisiana.

Mr. Macatee has been with the association about six years, and was district engineer at the Jacksonville office of that organization before coming to New Orleans two years ago.

Simplified Specifications for Quality Control

Prepared for Insertion in Architects' General Specification—Will Appear in May Issue

THE May issue of "Concrete" will contain a short form of quality control specifications for structural concrete work, suitable for insertion in an architect's general specification for a building at the point where the concrete work is dealt with.

Architects, structural engineers and specification writers have long needed a short form specification, based on the water-cement ratio method of controlling the strength and other properties of concrete. They have complained that the usual standard form of specification is entirely too long, and that much of it cannot be inserted bodily in a general specification for a building because of the large amount of duplication.

Contractors, too, have often complained to the effect that the water-cement method of control sometimes results in greater expense to them without compensation. This specification will make definite provision for extra payment in cases where changes in proportion ordered by the architect or the engineer in charge, or changes in quantities resulting from changes in water-cement ratio, bring about greater expense to the contractor.

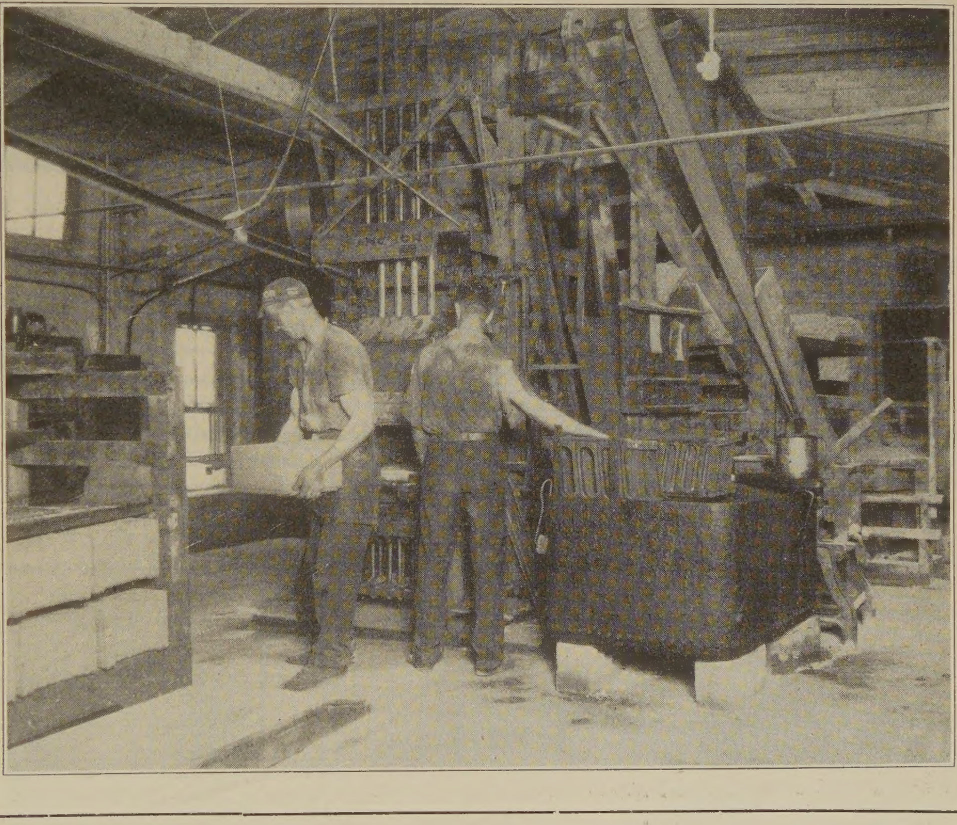
The fact that this specification is in condensed form does not mean that any essential features have been omitted. It covers all necessary points, but it does omit material which specification writers ordinarily place into the general provisions. It was prepared for the use of a firm of architects and structural engineers by several engineers who are well qualified for such work and who are considered authorities on the water-cement ratio method of controlling the strength and other qualities of concrete.

Building contractors will find that this specification gives proper recognition to their interests as well as to those of the other parties to the contract.

Twenty-Five Different Units With One Power Stripper

Crown Sidewalk and Block Company Reduces Overhead with Versatile Equipment — Twenty-Five Varieties of Size and Style — Uniform Quality Attained — Printed Data for Architects and Builders—Styles Numbered for Convenience in Ordering—Long Record of Service

MORE than forty years ago August Anderson, an earnest, industrious workman of good Scandinavian stock, came to Minneapolis and engaged in sidewalk construction according to the best practice of the times. The West was emerging from its pioneer era. As an indication of its progress it was tearing up its wood plank sidewalks and substituting the tar variety in some cases and, in the Twin Cities, walks of cast concrete slabs.



Single power stripper machine makes 25 sizes and styles of units

Precast Sidewalk Slabs

Mr. Anderson started making slabs. He made them in a small frame structure, with hand-operated equipment, stored them in the yard and delivered them as required to the sidewalk site, hauling them in horse-drawn carts.

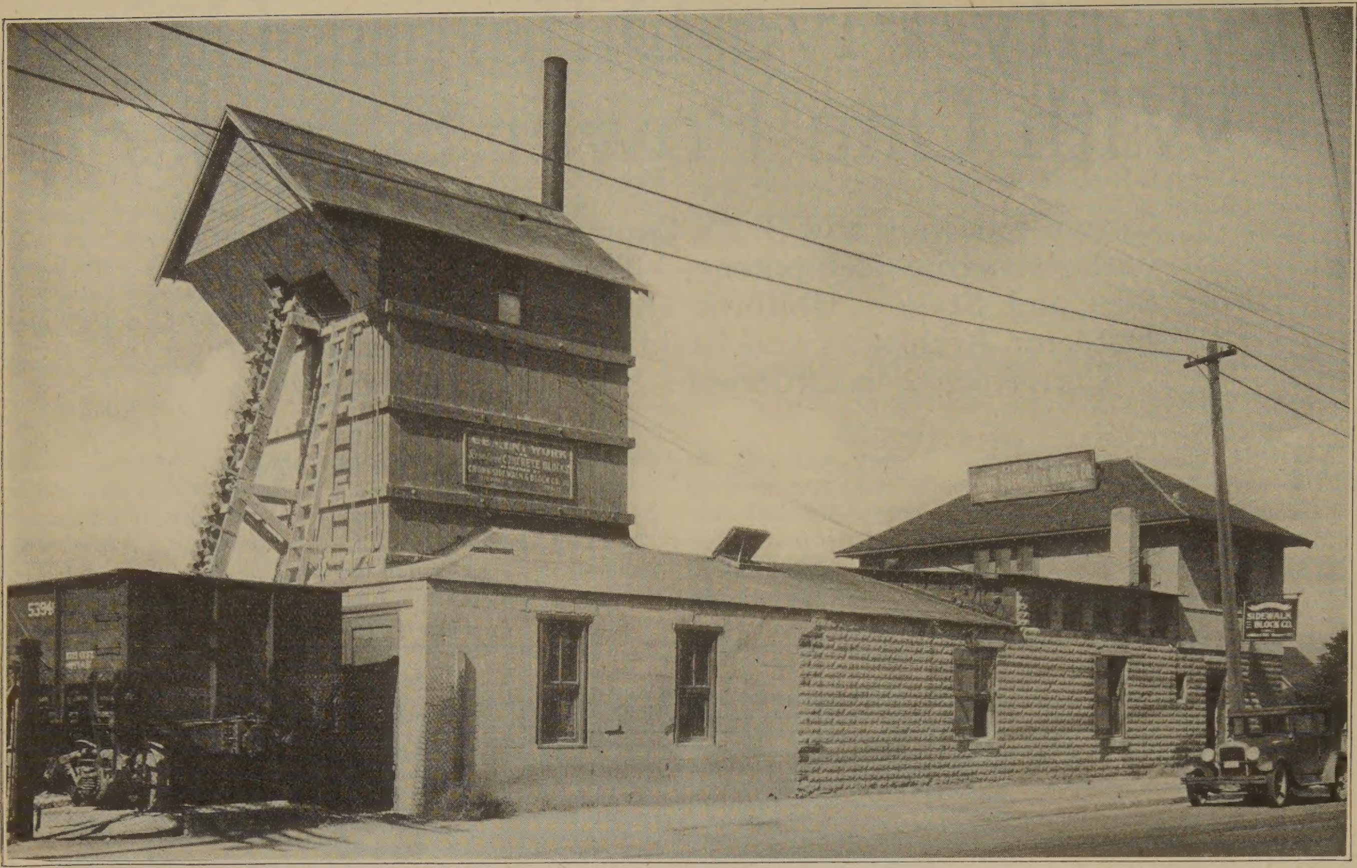
In those days, in Minneapolis, the favorite masonry material was a lime rock blasted from local quarries and laid in the wall in huge blocks or reduced to smaller units on the job, according to the stone mason's artistic taste and ambition.

Concrete Building Blocks Appear

Then it was that concrete building blocks first made their appearance in the West. Mr. Anderson was much interested in their possibilities, due to his experience with concrete in sidewalk slab manufacture. So he added building blocks to his output and changed the name of his company to the Crown Sidewalk & Block Company, the name which the company has retained to this day.

Hand Work and Strong Backs

The block manufacturing process in the Anderson plant, as in all other plants of the time, involved the employment of strong backs. Sand was loaded into a cart by hand-shoveling at the pit, drawn by horses to the plant, unloaded by hand, and mixed with cement and water by hand in shallow boxes with long handled hoes. The mixture was shoveled by hand into a mold box on a standard, and tamped by hand. When a unit was completed, the mold was taken apart and the newly molded block, weigh-



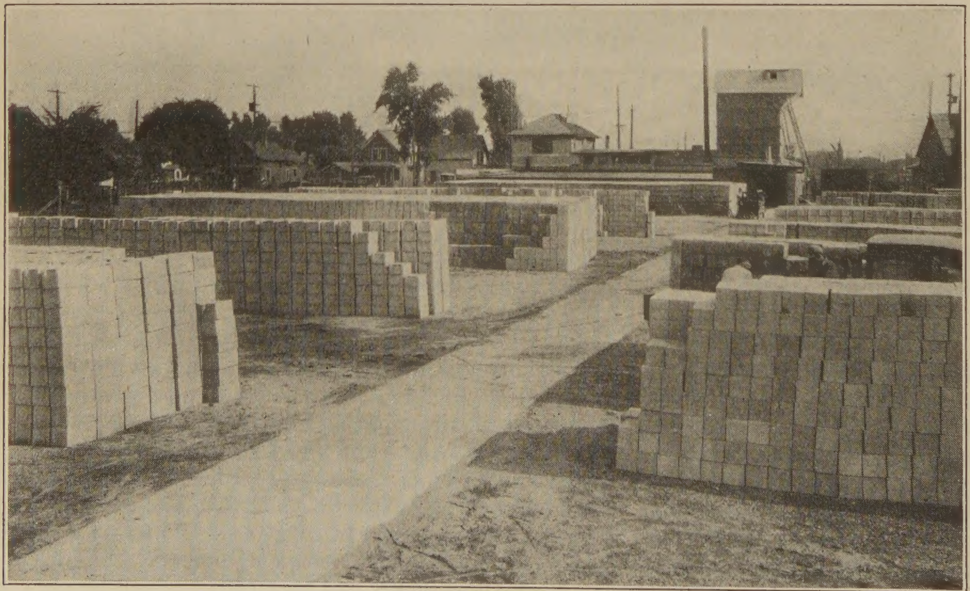
The modernized products plant of the Crown Sidewalk and Block Co., Minneapolis, founded 45 years ago

ing 100 lbs., was carried by a strong and willing laborer 200 ft. to a stock pile where the product of the plant was "dried." The production of fifty blocks in a day's time was considered good progress and a block plant with a stock of more than 500 units on hand was considered to have a dangerously heavy inventory. Every block that August Anderson offered for sale was a good block, in the light of the structural standards of the time. No building unit whose structural integrity was in question ever left Mr. Anderson's plant.

From the Old to the New

A lot of water has gone over the dam since that era—a lot of concrete has come down the chute. August Anderson has gone, and the greatest thing he left on this earth was the simple code of business ethics which he drilled into his four sons, Harry, Robert, Paul and Earl. They carry on the business.

Minneapolis and St. Paul now have modern, well managed concrete products plants. Perhaps the Anderson business is typical. Certainly through the years the Crown



Clean storage yard and neat stock piles are features that help sales plant has seen many improvements. Like other plants, the simple mold was discarded for the more smoothly operating block machine. Later power-tamping was added. Then a type of almost automatic machinery was used. The most recent improvement involved the abandonment of one very good type of machinery and the installation of simpler, sturdier and more versatile equipment that makes concrete masonry units at a surprisingly low manufacturing cost, with a minimum of repair expense—a a product that has more adequate strength and is true to dimensions.

Neat Stock Piles a Feature

A glance at one of the illustrations, showing the stock piles in the storage yard, will be sufficient to emphasize the contrast with the 500-unit stock of hand-molded blocks carried in the older days. In fact, there are two features about the modern Crown plant which are outstanding. One of them is the kitchen-clean appearance of the stock yard and the other is the remarkable range of styles and sizes of masonry units produced.

Versatile Equipment Makes Diversified Products

The stock piles are not only neat, they are complete. The Crown company makes 25 standard units. All these are made on the one Anchor power stripper machine, which is equipped with quick-change attachments for the production of all the standard and special sizes, styles and faces required. There are 25 different piles of blocks in the yard at all times, displaying as many different kinds or sizes of units. A customer can find in the yard about any kind of masonry unit he wants.

The Crown company shows commendable enterprise in its selling efforts. It advertises its product widely. It circularizes builders and architects regularly. One of its recent circulars contained scale drawings of the units most in demand, each unit bearing a number to provide ease in ordering.

The Plant Equipment

The plant itself is modern in every detail. It is not a large plant. It has only the one production unit; but that unit, as has been indicated, has versatility of output that makes it most efficient. Raw material is elevated from railway cars to the bins above the mixer, concrete travels by gravity to the block machine, the finished product is put into kilns and removed from kilns on wood racks handled by power-lift jack trucks made by the Crown efficiency engineer in the company's own machine shop.

Robert Anderson is secretary of the company, Earl Anderson, vice-president and treasurer and George Erickson is chief mechanic. The chief mechanic's job in this plant consists of something more than wearing the title. It is his job to hew to the line marked forty years ago by August Anderson. The Crown product must test high. It does. Recent tests have shown an average crushing strength of 1500 lbs. per square inch on the net area.

That is the way August Anderson would have it.

Another View on Admixtures and Admixture Standards

Bearing further on the subject of admixtures and admixture standards, discussed in a letter from Kristen Triis, a Norwegian engineer, published on page 28 of the February (1930) issue, the following letter from George Conahey, of the Johns-Manville Corporation, will be of interest.

Mr. Conahey's letter follows:

In several issues of your magazine there have appeared articles discussing the value of the many admixtures on the market to improve the many properties of concrete. As a producer of one of these admixtures, we appreciate the opportunity of entering into this discussion. Before doing this, however, we would like to state the position and attitude of our company in regard to its own material "Celite."

The material "Celite" is a high grade diatomaceous silica manufactured from large deposits of this material at Lompoc, California. It has been successfully used during the past fifteen years as a plasticizing or workability agent for use in all portland cement mixtures. It can be mixed with the cement at the mill or with the concrete, mortar, stucco or plaster on the job. It has produced the results we claim for it so that now eight cement companies are mixing this material with their cement at the mill. Celite cannot be substituted for the cement, as it is practically an inert material. It can better be considered as an ultra-fine aggregate providing the necessary fine material to produce a "fat" and "workable" mixture.

"Celite" will aid in producing a more uniform concrete which has the desired working qualities. We all know that a concrete which can be placed in a uniform condition, without segregation and without excess mixing water, will have all the desirable properties of good concrete, i. e., durability, watertightness, uniform strength, etc. Accordingly, "Celite" has been offered to the trade not as a "cure-all" for all ills of poor concrete but rather as an aid to make good concrete better.

Mr. Triis[1] has suggested that the A. S. T. M., or some other technical organization, should authorize or certify the admixtures which have proved of value in the field. The admixture committee of the A. S. T. M. has been endeavoring to obtain complete information on all these materials so that engineers and architects would judge their value and select the one they desired to use. This appears to be a simple problem, but a surprisingly limited amount of technical data is available on many of these materials. Also, the reluctance of many of the admixture producers to discuss the technical merits of their materials is equally surprising. The admixture committee plans to continue in its efforts to obtain and summarize all data available on admixtures and to publish their findings as soon as possible in the *Proceedings* of the A. S. T. M.

All sorts of materials are at the present time available on the market to be used as an admixture in concrete. Practically all of them make the same general claims—that is, workability, greater uniformity, watertightness, etc. Up to the present time we have been unable to obtain standard methods of testing many of these properties of the concrete. Considerable research is being carried on to develop a method of measuring workability. Likewise, a new committee has been appointed by Committee C-9 of the A. S. T. M. to develop a standard method for measuring the permeability of the concrete. Just as soon as methods are made available to test these properties of concrete we no doubt will be able to obtain definite measurements as to the value of these materials; but, until that time, there appears to be no way out of the confusion.

George Conahey
Sales Engineering Department,
Johns-Manville Corporation.

New York City, February 24, 1930.

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[1] February Concrete, p. 28.

Design of Retaining Walls

Formulas and Data Usually Required by Designer—Simple in Theory and Easy to Apply—Years of Practice Prove Reliability

By W. W. HAY

THERE are as many theories for the pressures acting behind a retaining wall as there are specified combinations of unit stresses for reinforced concrete design. No such theory is any better in its application than the selected values for unit weights for the retained materials, selected unit stresses, or other factors entering into the design. What, then, is the designing engineer to do?

The A. R. E. A. Formulas

Probably the majority of concrete retaining walls which have been built in this country in recent years have been designed in accordance with some formula similar to those again presented here. We refer to those formulas recommended by the American Railway Engineering Association as long ago as 1911, but not finally adopted as standard practice until 1917. These formulas deserve a wider use and more space in standard textbooks. They are simple in theory, easy to apply, and other factors being equal, are absolutely reliable. The most severe test on a wall retaining relatively dry, granular materials is that of a fast heavy train running on a roadbed of uncertain character; yet the safety of such operation is dependent upon the practical application of the theory represented by these formulas.

To quote from the discussion of the formulas[1]: ". . . no theoretical formula can be more than an aid to the experienced designer. The main value of theoretical formulas is in obtaining economical proportions, in obtaining a proper distribution of stresses." It will be found that the continued use of the particular formulas will give the designer such a sense of proportion that it seldom is necessary to try more than once before a proper set of dimensions can be secured that will satisfy both stability and bending moments.

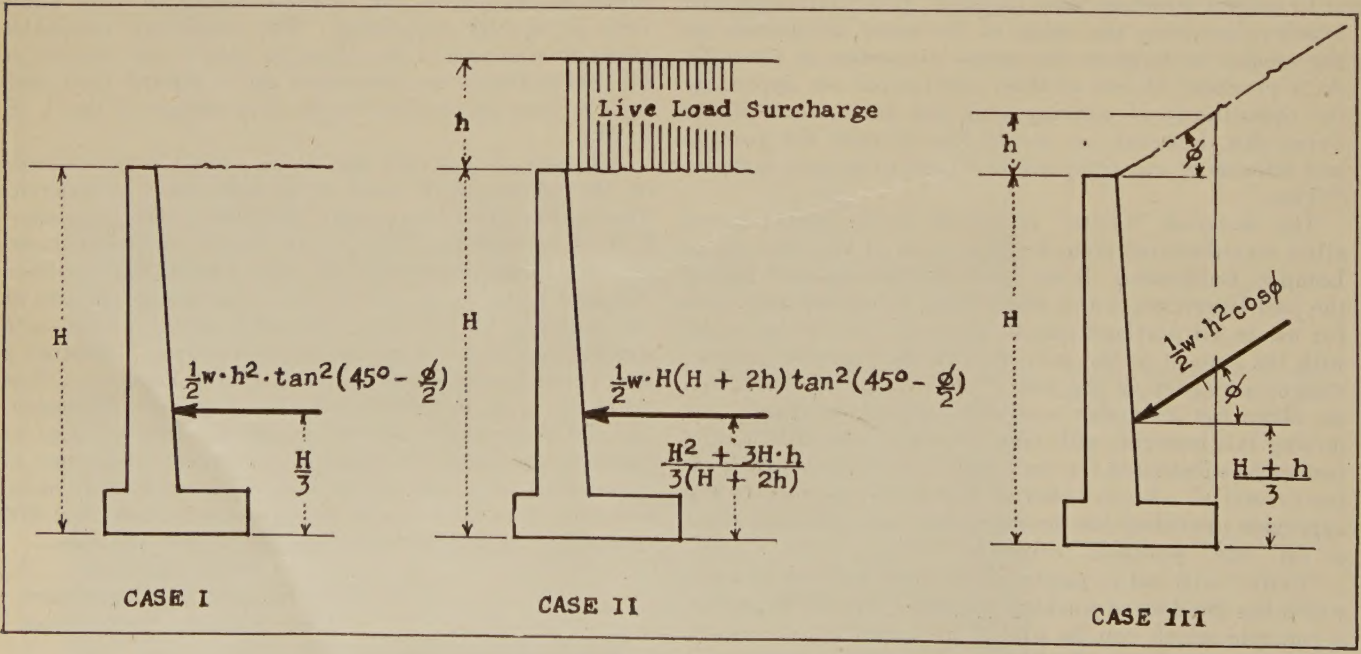
Sources of Data

Some of the material that follows is original with me and is a development of my own study and practice. The constants in Tables 2 and 3 are selected and weighted from the best American and European texts. Figure 2 is based on data tabulated by me over a number of years, covering walls actually constructed.

Three Most Common Cases

The three cases shown in Figure 1 are those customarily met with in routine practice. Case I and Case III are for quiescent loadings, but Case II requires some consideration of the magnitude and distribution of the live load and of the effect of impact on the retained material. While the original theory leading to the given formulas was based on two texts, and fundamentally is known as Rankine's Theory, the same formulas are susceptible of much simpler derivation in accordance with Coulomb's Theory. They have a wide use, in the form given, throughout Europe.

It should be noted that when allowing for impact in the given formula (Case II), these live loads are equivalent to raising the height of the wall 8 ft. to 25 ft., according to the class of live load encountered. Many times the loads (Table 1) will be encountered in ordinary practice, particularly in and about industrial plants.



H
$\frac{1}{2}w \cdot h^2 \cdot \tan^2(45° - \frac{\phi}{2})$
$\frac{H}{3}$
CASE I
h
Live Load Surcharge
H
$\frac{1}{2}w \cdot H(H + 2h)\tan^2(45° - \frac{\phi}{2})$
$\frac{H^2 + 3H \cdot h}{3(H + 2h)}$
CASE II
h
ϕ
H
$\frac{1}{2}w \cdot h^2 \cos\phi$
ϕ
$\frac{H + h}{3}$
CASE III

Figure 1

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[1] *Manual*, 1921, pp. 425, et seq.

TABLE 1

Equivalent Live Loads Uniformly Distributed

Loading	Equivalent Load in Lb. per Sq. Ft.	Distribution
Cooper's E50	1,100	19′ x 10′
Cooper's E40	840	19′ x 10′
Cooper's E30	630	19′ x 10′
Interurban railway	380-480	19′ x 10′
Steel ore gondola	1,260	9′6″ x 10′
Steel coal gondola	740	9′6″ x 10′
Copper concentrate car	820	9′6″ x 10′

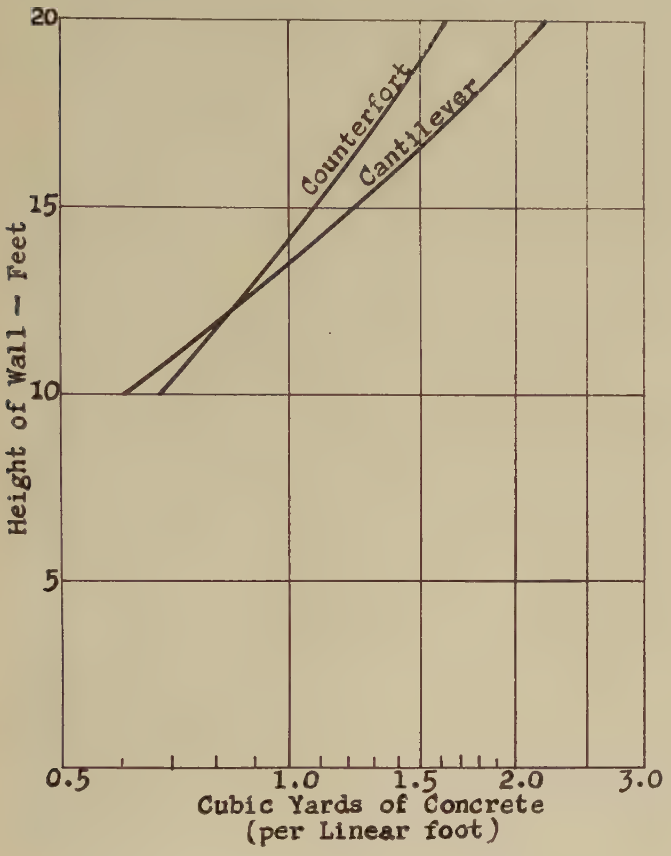


Figure 2

Economical Types of Retaining Walls

For any except very low toe-walls, the reinforced concrete wall is cheaper than mass concrete. For small walls, the ordinary T-section, or cantilever, is the cheapest in materials and money. Between 10 ft. and 15 ft. in height, there is a choice between the plain cantilever type and the counterfort type in materials, as shown in Figure 2, but the net dollar comparison should be made on comparative designs and with considerable detail. The quantities shown in Figure 2 will be increased about 20 per cent for each 5-foot surcharge due to live load.

TABLE 2

Weights and Angles of Repose of Retained Material

Material	Weight in Lb. per Cu. Ft.	Angle of Repose
Earth, usual, drained	80-100	27°-37°
Sandy	90	27°
Water-bearing	110	30°
Clay, dry soil	110	26°
Water-bearing	130	20°-25°
Sand, usual, moist	80-100	32°
Dry, bank	100	35°
Water-bearing	120	30°
Gravel, bank	120	26°-35°
Ordinary embankment	100	33°42′(1½:1)

Toe and Heel Pressures

Having determined the magnitude and direction of the resultant overturning thrust and the moment sections, the foundations and bearing should be very carefully studied. Investigate the supporting soil for maximum bearing pressure due to overturning and for sliding. The general formulas for the pressures on the base are:

Pressure at toe $= P(4B - 6Q)/B^2$ (See Figure 3)

Pressure at heel $= P(6Q - 2B)/B^2$

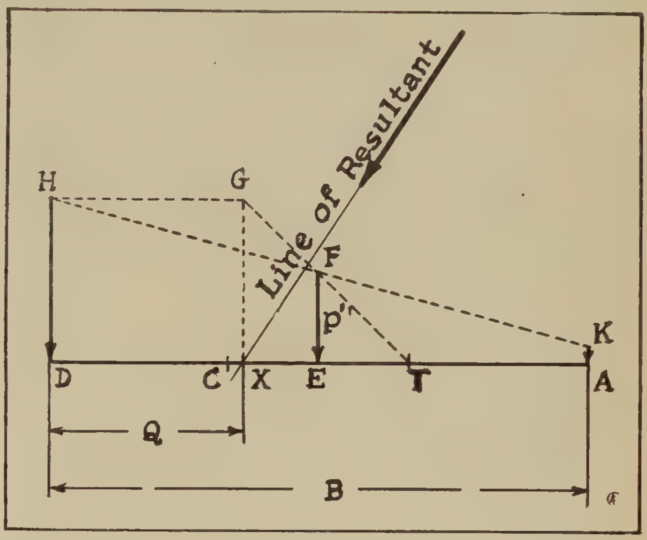


Figure 3

These pressures can be very quickly found graphically by the construction in Figure 3, in the following manner:

At the center of the base lay off FE = average pressure on the base AD. This average pressure is equal to P/B and is designated as p' in Figure 3.

Erect the perpendiculars at X and at D.

Through the third-point T, opposite the center from X, draw through F a line to meet the perpendicular from X at G; draw the horizontal line from G to meet the perpendicular from D at H.

Through F draw the line HFK to meet the perpendicular from A at K.

Then HD is the maximum pressure at the toe of the wall and KA is the minimum pressure at the heel.

Proof:

$$\frac{TE}{TX} = \frac{FE}{GX}; \text{ but } TE = \frac{B}{6}$$

$$\text{and } HD = GX = \frac{FE \times TX}{TE}$$

$$\text{in which } TX = \tfrac{2}{3}B - Q$$

$$\text{and } FE = P/B;$$

$$\text{hence } HD = \frac{P}{B} \cdot \frac{(\tfrac{2}{3}B - Q)}{\frac{B}{6}}$$

$$= \frac{P}{B} \cdot \frac{(2B - 3Q)}{\frac{B}{2}}$$

$$= \frac{P(4B - 6Q)}{B^2}$$

Foundations, Drainage and Joints

The foundations of any wall should be below the local frost level. The filling behind the wall should be carefully drained to prevent the collection of water and consequent hydrostatic pressures. When the cost is not prohibitive, a porous granular soil, such as gravel, should be filled against the back of the wall, and open tile drains laid at the heel. This will not only prevent the accumulation of water on the back of the wall, but will also keep it dry enough so there will be little or no frost immediately adjacent. We see walls rendered unsightly by seeping waters through cracks generally developed by the heaving action of frost. Cut the wall through at short intervals and provide an elastic joint, or reinforce it sufficiently to take care of all expansion.

TABLE 3

Safe Bearing Pressures and Friction Coefficients

Material	Safe Pressure in Tons per Sq. Ft.	Friction Coefficient
Ordinary earth	2 to 4	0.34
Usual clay	2 to 3	0.50
Hard clay*	4 to 6	----
Sandy clay	3 to 4	0.50-0.60
Firm, coarse sand	4 to 6	0.60
Coarse gravel	6 to 8	0.45-0.60

---

*May vary from plastic, greasy soil to rock-like formation.

British Report on Use of Salts in Concrete Mixing Water

By A. C. BLACKALL

Sodium Chloride and Calcium Chloride Studied—Action Differs with Different Brands of Cement—Corrosive Action on Steel—Recommendations on Use of Each Salt

For a considerable number of years the addition of a soluble salt to the mixing water of concrete has periodically been recommended with the object of preventing or decreasing the damage likely to be caused by exposure to frost during mixing or early curing. The salts employed have been calcium chloride or sodium chloride. Such action, if it occurs, may be due possibly to the effect of the salt either in lowering the freezing point of the wet mixture or, by increasing the rate of evolution of heat on setting, in delaying the freezing action until the material is sufficiently strong to withstand the disruptive effect of frost. The salt may also hasten the setting and hardening processes and so cause sufficient strength to be developed to resist the frost, or some combination of these actions may occur.

Much Variation in Results

The available literature on the subject reveals appreciable differences between the results of different observers. As a result, it was thought desirable that a summary of it should be prepared, to enable a judgment to be formed of the extent to which the addition of these salts in the mixing water is justified, and the precautions with which, if at all, they should be employed. This summary was taken in hand by Dr. W. N. Thomas for the Building Research Board of the British Department of Scientific and Industrial Research, and the latter body has now published his findings.

According to Dr. Thomas' report, there appears to be no doubt that both calcium chloride and sodium chloride, when added in suitable proportions to the mixing water of portland cement mortar or concrete, afford considerable protection against a limited degree of frost during the early setting and hardening period, although no such advantage is found with aluminous cements.

Apart from more serious objections which may occasionally be raised, each salt is liable to cause superficial defacement of the material, the sodium chloride by efflorescence and the magnesium chloride by staining. The effect of additions of the salts is to lower the freezing point to the extent of 4 deg. C. for 7 per cent addition of sodium chloride and fractionally less for calcium chloride, and to greater or less extents for greater or smaller additions.

Effect on Setting Time

The effect on setting time is material, because the sooner the material sets the less likely is the frost to exercise a disruptive action on it. The results appear to vary with the proportion of salt added, the brand of cement, the temperature, and the impurities contained in the salt. With calcium chloride results differ in regard to small percentages of salt, say of about one-half per cent of the weight of the cement, some investigators finding an acceleration and some a delay in the setting. With sodium chloride similar anomalies occur, and observations made at the Building Research Station, Watford, showed contradictory results with different brands of cement, although with aluminous varieties the setting was invariably retarded. The results in respect of the effect on the strength of neat cements, mortars, and concretes, which are much more numerous, are even more conflicting. The balance of evidence appears to indicate that the employment of sodium chloride is frequently followed by a serious decrease in strength, and has led Dr. Thomas to the conclusion that on this ground it is not to be recommended.

With regard to calcium chloride, the use of which is advised by many researches, some experiments show a decrease of strength, particularly in tension, but many tests show an increase, even after one to three years at normal temperatures, especially in proportions of from 2 to 4 per cent of anhydrous salt reckoned on the weight of cement. The conclusion suggested is that while calcium chloride is undoubtedly a valuable admixture in certain cases, the existing absence of fundamental knowledge of some of the reactions makes it necessary to use it with great care.

Corrosion of Reinforcement

The data concerning the liability of sodium chloride to attack reinforcing bars is contradictory. Many observers have found the metal free from rust in concrete which has been mixed with sea water, but in other cases marked deterioration has occurred, and the salt has been found concentrated near the steel. There is little direct evidence as to the effect of calcium chloride in accelerating or initiating corrosion, but the possibility of either salt doing so is increased if it is contaminated with hygroscopic impurities such as magnesium chloride. With either salt, however, the presence of as little as 0.03 per cent has been found to cause a greatly increased amount of corrosion through stray electric currents, and several authorities now forbid their use.

Dr. Thomas suggests, as a result of a review of all the available data on the subject, that neither calcium chloride nor sodium chloride should be used in the preparation of reinforced concrete, nor with aluminous cements. On the ground of its possible effect in reducing strength the use of sodium chloride is also deprecated by him; and on data at present available the use of these admixtures appears advisable only with calcium chloride and subject to the precautions above outlined.

~ EDITORIAL ~

Local Committees Are Getting Results

FROM a small city, a medium size city and a large city we hear of specific action taken by local organizations of business men to hasten local construction work which has long been hanging fire.

In Greenville, N. C., the Chamber of Commerce calls it a "business stimulation plan." They ask no one to build anything that is not needed. On the contrary, the plan calls for doing long-needed public construction now. Districts are being organized for the construction of sewer lines in suburbs that do not now have sewers. City streets that need repairing or re-paving are to be repaired or re-paved. Public and private buildings that need repairs are to be given attention.

In Duluth the civic development bureau of the Chamber of Commerce is working in co-operation with other citizens' committees in an effort to stabilize local business conditions. They are working largely with employers of labor, urging them to keep operations on an even keel and eliminate fluctuations.

In Chicago the Association of Commerce is cooperating in every possible way to aid city and county governing bodies in removing legal obstacles or speeding up legal procedure in connection with construction work running into millions of dollars.

The three cities named are taken more or less at random. Similar activities are under way in many other cities, and the favorable results are already in evidence.

Specifications for Ready-Mixed Concrete

THE American Concrete Institute, through Committee 504, has undertaken the preparation of a specification to control the production, delivery and placing of ready-mixed concrete.

This action is timely, for the ready-mixed concrete idea has spread rapidly in the last two or three years. Three years ago it was a rare thing to see the use of ready-mixed concrete in cities like New York or Philadelphia. Today one can see ready-mixed concrete trucks in the vicinity of almost every large construction job in Manhattan, while in Philadelphia one concern alone marketed 250,000 cu. yd. in 1929. In Indianapolis one company marketed 50,300 cu. yd. last year.

The development thus far has included three methods. The oldest method is the one where the concrete is completely mixed at a central plant and is delivered to the construction job in trucks. A later development was like the first, except that delivery is made in special trucks equipped with an agitating mechanism which continues the mixing during the haul. The third development was that of the so-called transit-mixed concrete, in which the dry materials are proportioned at a central material storage plant, water is added and the mixing is accomplished in a revolving drum on the truck itself, during the trip to the construction site.

In the meantime it is only proper that the Institute should try to safeguard this new industry against abuses from within. The adoption of standard specifications for the guidance of architects, engineers and inspectors will go far toward anticipating the evils that might otherwise develop.

When You Cut the Price of Block

HERE is something for the concrete products manufacturer to think about—especially the manufacturer who may just now be considering a cut in price to "stimulate" business.

A 5 per cent cut on your regular price compels you to do 25 per cent more business to break even.

A 5 per cent increase over your regular price permits you to stand a 20 per cent drop in volume of business without decreasing your net profit.

These two elementary but important facts were given to the Wisconsin Concrete Products Association by no less an authority than Harry J. Colman, industrial engineer and economist. Products manufacturers who have gone through price wars know these facts from bitter experience.

Modernizing as a Market for Concrete Products

LOANS for the construction of new homes are as yet hard to get. This reduces the demand for concrete building units in a market where it has a strong foothold.

On the other hand, we are informed that where building and loan associations are refusing loans of six or eight thousand dollars for new construction, they do not hesitate to loan fifteen hundred or two thousand dollars for modernizing an old house.

Here is the opportunity for block manufacturers or the organizations representing them to regain a part of the market that is temporarily lost. Many old dwelling houses that are being modernized will require concrete block for new foundation walls, for porch foundations and for basement piers.

Home modernization campaigns have been successful in many towns and cities. It can be a success in your town if you and others in the building industry will take the initiative and make it a success.

Current Activities of Organized Groups

Many and varied are the problems either in course of solution or recently completed by organized societies or groups of individuals.

The busy reader may find on this page a reference to the very thing that has been troubling him, or he may find an opportunity to get new information that will further his own interests or increase his own usefulness.

Readers are urged to file these items for future reference even if they are not needed at the present moment.

A. S. T. M. Tentative Specifications for High Early Strength Portland Cement

The American Society for Testing Materials has now issued its new tentative specifications for high early strength portland cement, mentioned on Page 26 of the March issue of Concrete. The specifications, which were issued on recommendation of Committee C-1, were received by Committee E-10 on Standards (under the new procedure whereby tentative standards may be submitted in the interval between annual meetings of the Society) and the specifications were accepted by that committee as tentative. The specifications have accordingly been issued, the date of approval being February 18, 1930. They are published with the report of the committee and are being distributed to all members of the Society who requested copies.

The new tentative standard is known by the serial designation of C 74-30 T.

Formulas for Design of Flat-Slabs Under Concentrated Loads

Specifications and formulas for the design and construction of girderless flat slabs under moving concentrated loads were adopted on March 14th at the thirty-first annual meeting of the American Railway Engineering Association.

Formulas published heretofore for use in the design of flat-slab structures have been applicable to the case of uniformly distributed loading only. In consequence, designers have been compelled to restrict this type of design to structures subjected to uniform load distribution, or to loads that could be converted into equivalent uniform loads with a fair degree of accuracy.

The new formulas will open up the broad field of bridge design to the flat-slab type of construction.

Checking Up on Responsibility of Contractors

Architects, public officials and others who may be called upon to pass upon the financial responsibility, skill and integrity of contractors may obtain verified information about the performance records of individual contracting concerns by addressing the Bureau of Contract Information, Munsey Building, Washington, D. C.

This bureau was formed as a fact-finding organization, to co-operate with those responsible for the award of construction contracts, and with surety companies and organizations which extend credit to contractors, in the effort to rid the construction industry of the irresponsible and inexperienced bidder.

Information is given only to those entitled to it by reason of being responsible for the award of public and private construction work, the writing of contract bonds, or the extension of credit to contractors.

The bureau makes no recommendations, but simply supplies the assembled and verified facts in a given instance.

May Allow Higher Working Stresses in Highway Bridges

At a meeting scheduled to be held in Washington during the first week in April the Committee on Bridges and Structures of the American Association of State Highway Officials is expected to vote on the question of permitting working stresses in reinforced concrete highway bridges in proportion to the actual strength of the concrete going into the structure.

At the present time the specifications sponsored by the A. A. of S. H. O. allow a working stress of only 650 pounds per square inch for the flexural compression in concrete under bending stress, where the 28-day crushing strength of the material is 2,000 pounds per square inch. For 2,800-pound concrete the corresponding working stress may be 750 pounds per square inch. No recognition is given to concrete of greater strength than 2,800 pounds per square inch.

Designers of reinforced concrete highway bridges have been greatly handicapped by these over-conservative requirements, for the reason that federal aid is withheld from highways on which bridges are designed for higher stresses than those sanctioned by the A. A. of S. H. O.

Fire-Resistive Classification for Hollow Concrete Building Units

Manufacturers of hollow concrete units and architects who specify such units may obtain authentic information regarding the fire-resistive classification assigned to walls and partitions of this material. The information is printed in the "List of Inspected Fire Protection Appliances," issue of July 1, 1929, page 4, published by the National Board of Fire Underwriters, 85 St. John Street, New York. Additional data will be found on page 2 of the January (1930) supplement to the above publication.

Briefly, the following classifications are established for walls and partitions of units manufactured under the inspection and certification service of the Underwriters' Laboratories.

1. 12-inch walls with incombustible structural members framed in, not less than 6 hours.
2. 12-inch walls with combustible structural members framed in, not less than 3 hours.
3. 8-inch walls with incombustible structural members framed in, not less than 3 hours.
4. 8-inch walls with combustible structural members framed in, not less than 1 hour.
5. One-half hour is added to the foregoing periods by portland cement stucco or by portland cement or gypsum plaster of ¾-inch thickness on either side of the wall.

How to Save in Concrete Form Work

Fourth of a Series of Articles on Details of Economical Concrete Forms—Girder, Beam and Floor Slab Forms—Lumber Dimensions—Changing Forms When Column Sizes Change—Special Floor Forms

IV—Forms for Girders, Beams and Floor Slabs

By A. B. MacMILLAN
Chief Engineer, Aberthaw Company, Boston, Mass.

THIS description of forms for girders, beams and floor slabs refers to what is ordinarily termed beam-and-girder construction. The usual floor of this type consists of girders extending from column to column, beams framing into the girders at the third-points of the girder span, and into the columns, and slabs extending from beam to beam. If the columns are spaced 21 feet from center to center, the beams will be 7 feet from center to center.

Lumber Sizes Used

Lumber sizes for various parts of the form work are shown in the drawings. In general we use the following:

(1) For beam and girder bottoms, 2-inch plank dressed down to 1¾ inches by the width of the beam.

(2) For beam and girder sides, 1 1/16-inch dressed.

(3) For boards of floor form panels, ⅞-inch dressed.

(4) For ledgers and ribbands, 1-by-6 nominal size, rough or dressed.

(5) For cleats (or battens) on beam and girder sides, 2-by-4 nominal size, rough or dressed.

(6) For floor form joists, 2-by-6 to 2-by-10, depending on load and span.

(7) For posts and heads of jack frame, 3-by-4 nominal size, rough or dressed.

Length of Lumber

The length of various parts and pieces of the form work may likewise be determined from the drawings, and these matters will be discussed in other parts of this article. Nevertheless, the following lengths of some of the principal parts are given here for convenience—

(1) Length of girder bottom equals distance between faces of columns, less twice the thickness of the column form boards or lagging.

(2) Length of girder sides equals length of girder bottom, less 2 inches.

(3) Length of beam bottom equals distance between sides of girders, less twice the thickness of girder form boards.

(4) Length of beam sides equals length of beam bottom, less 2 inches.

(5) Length of floor form joists, 4 inches less than distance between sides of beams.

Girder Forms

The girder forms are the first to be set up. Both the girder forms and the beam forms are made in three parts, namely, the bottom plank and the two sides. As will be explained later, the bottom and sides are assembled separately to permit removal of the sides without removing the bottom planks, when the forms are stripped.

The ends of the girder forms are supported by blocking up from the uppermost column yoke, or on a special framing of 2-by-2's fitted around the opening in the column form, as shown in Figure 18 of the previous article in this series. Intermediate supports are supplied by posts or jack frames, spaced not more than 6 feet apart, and shown in detail in Figures 19 and 20.

Notches for Beams

The sides of the girder are notched out for the beams. It is well to cut the opening 1 inch larger all around than the size of the beam, to leave room for ⅞-inch fillets and still leave leeway to prevent the forms from binding.

The Girder Sides

The girder sides, as stated before, should be cut to a length 2 inches less than the length of the bottom plank, so that the sides may easily be removed when the forms are stripped. The 1-inch shortage at each end, as shown in Figure 21, is filled in by beveled 2-by-4's which are nailed against the column form with double-headed nails. These 2-by-4's may easily be removed and the sides let down when the girder forms are to be stripped.

Assembling the Girder Forms

As stated previously, the girder sides and bottom are assembled separately. The boards of the sides are nailed to 2-by-4 battens or cleats and are set into place, and the bottom plank is likewise set into place. The girder sides may extend either to or below the bottom of the bottom plank, depending on how the board widths come out. In either case the level of the bottom plank may be adjusted with wedges, as shown in Figure 20, after which the sides are nailed to the bottom plank with double-headed nails. These nails, of course, are removed just prior to stripping the forms from the girder sides.

Note in Figure 20 how the girder sides are held in place at the bottom by 1-by-6 ribbands set against the side cleats and nailed to the 3-by-4 heads of the jack frame supports. Note also how the upper part of the girder sides are held in position by 3-by-4 liners, tie wires and spreaders.

Beam Forms

Erection, assembly and stripping of beam forms is identical in almost every respect with the procedure followed with the girder forms. This may be seen by referring to the two cross-sections in Figure 20. The 3-by-4 liners near the top of the girder sides are not needed on

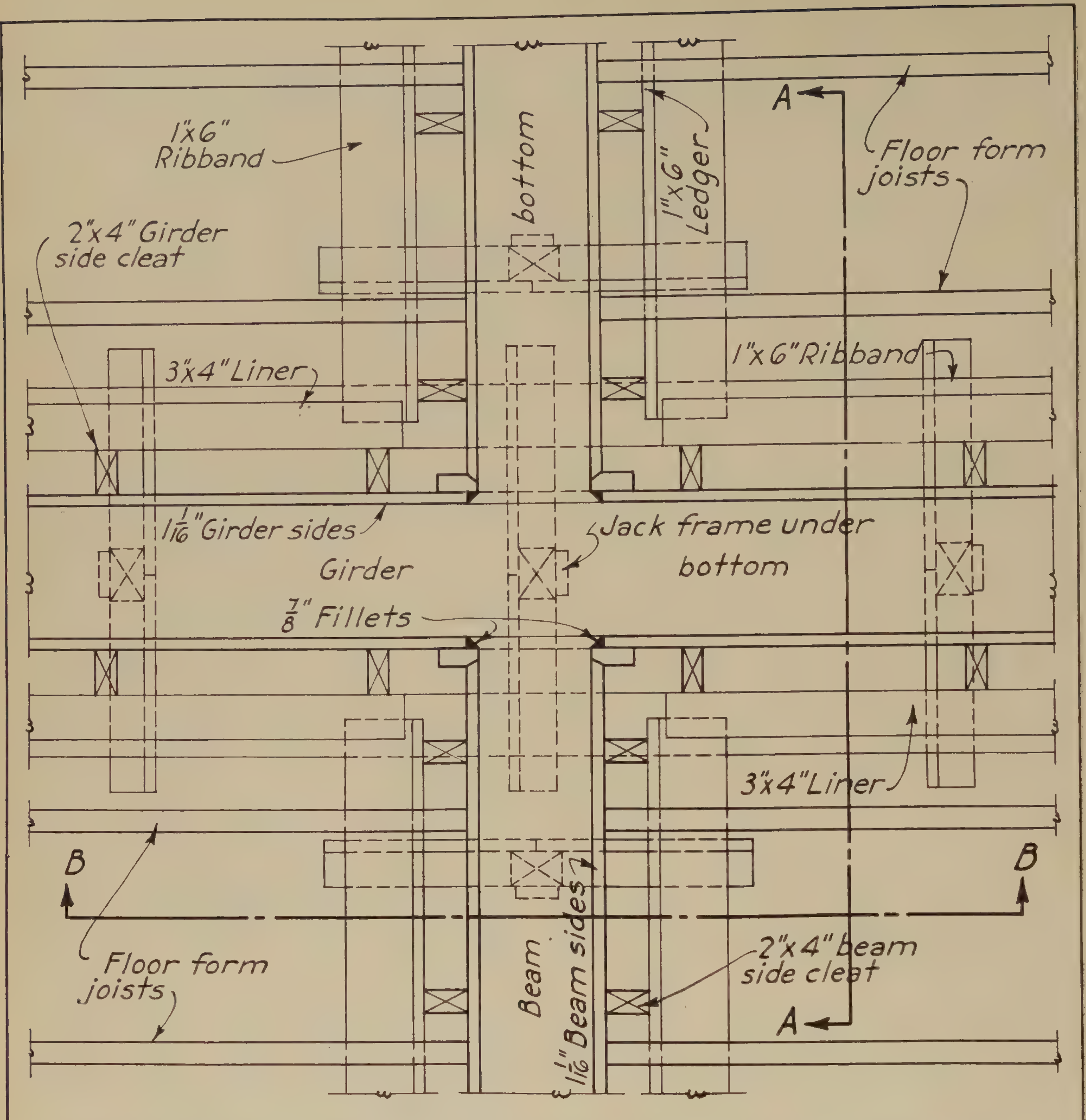


FIGURE 19 - PLAN OF FORM WORK FOR SLABS BEAMS AND GIRDERS

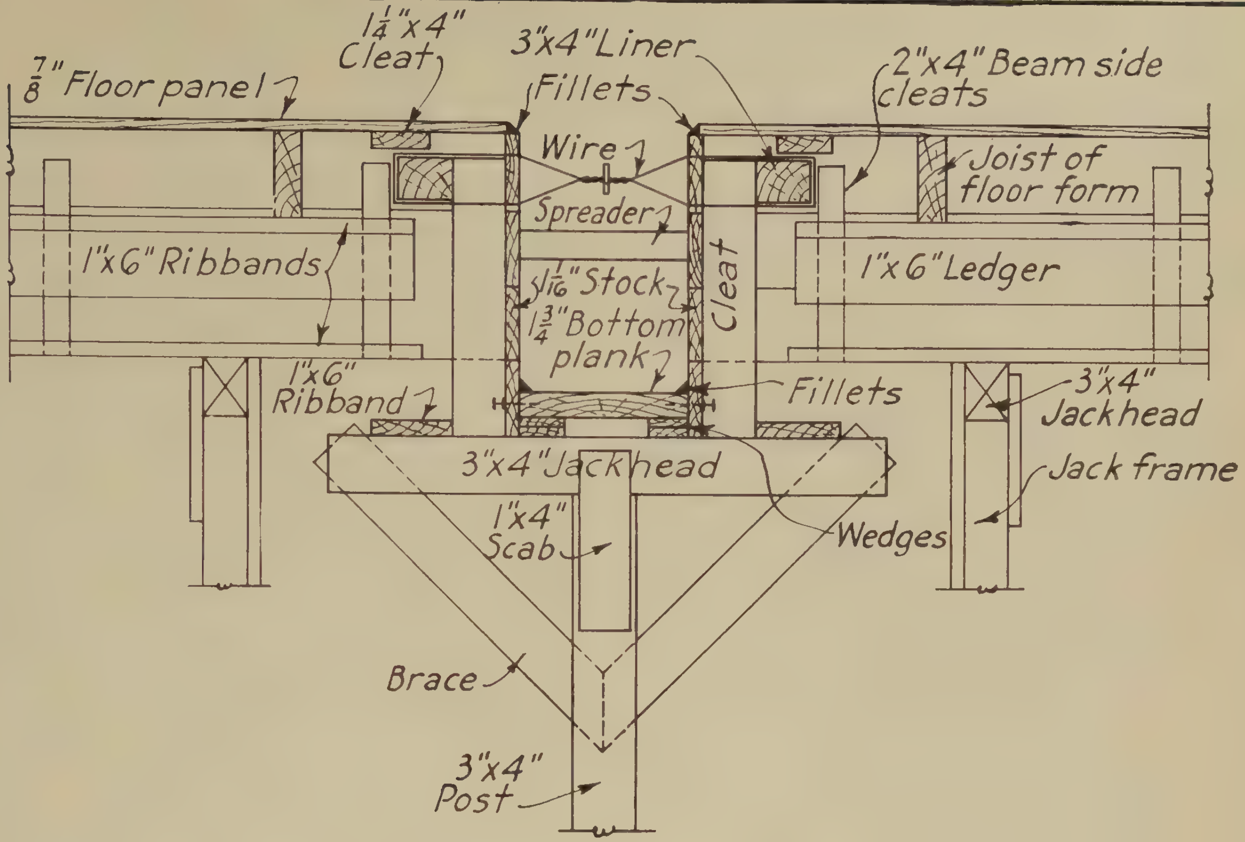
the beam sides for the reason that the latter are held in place by the joists of the floor forms. A second difference in detail is the 1-by-6 ledger strip nailed to the beam side cleats as a support for the joists of the floor forms.

In erecting the beam forms the ends are supported on 2-by-4's nailed to the sides of the girder forms at the level of the bottom of the beam sides.

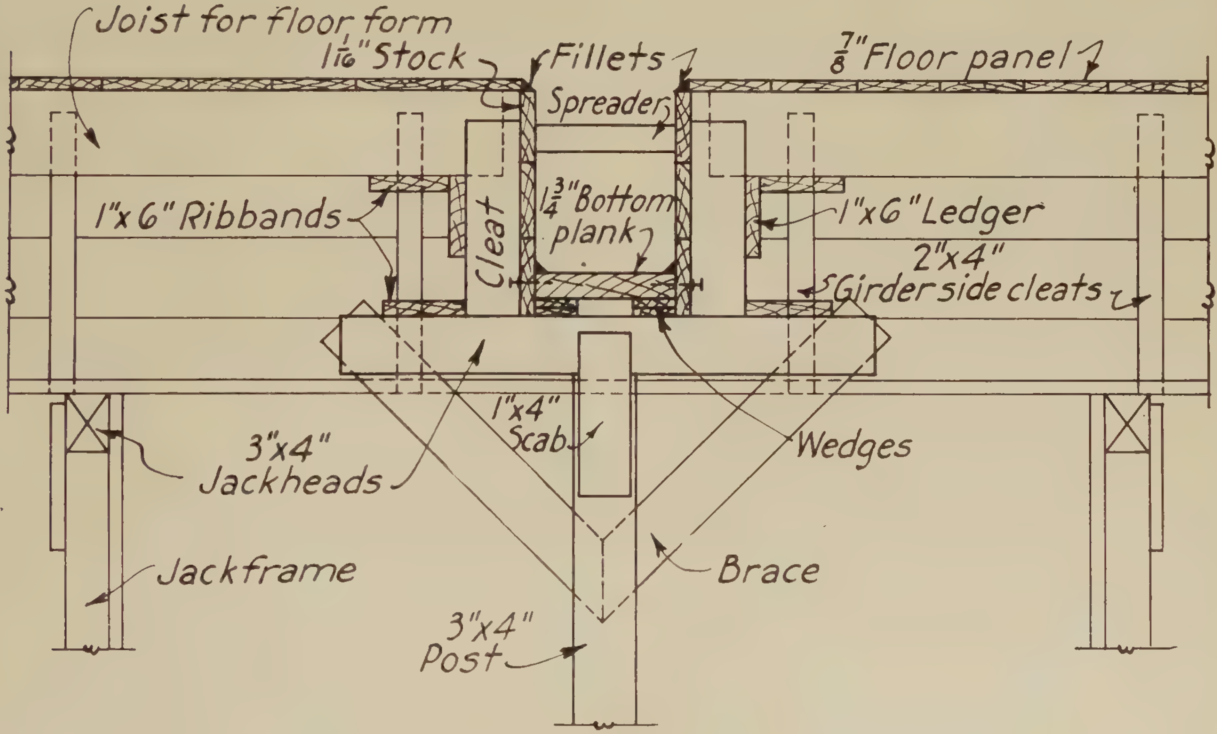
The length of the beam bottom plank is, as previously given, equal to the distance between sides of girders, less twice the thickness of the girder form boards. The sides are 2 inches less in length than the bottom plank, and the 1-inch shortage at each end is again filled in by beveled 2-by-4's which are nailed against the girder sides with double-headed nails, as shown in Figure 21. As with the girder sides, the removal of these 2-by-4's permits removal of the beam sides when the forms are stripped.

Floor Panels

For the floor panels we use ⅞-inch boards nailed to joists ranging from 2-by-6 to 2-by-10 in size and spaced from 18 to a maximum of 27 inches for ⅞-inch boards, depending on the load to be carried and the distance between the concrete beams. The table designated as Figure 22 gives the size and spacing of joists for different



SECTION A-A (SEE FIG. 19)



SECTION B-B (SEE FIG. 19)

FIGURE 20 - CROSS SECTION THROUGH FORMS FOR BEAM AND GIRDER

spans between concrete beams, and different thicknesses of the fresh concrete slab to be supported. In determining the load on the joists we assumed the weight of the concrete at 150 lbs. per cu. ft., and made an additional allowance of 35 lbs. per sq. ft. for construction loads.

Dimensions of Floor Panel Material

The length of the floor panel boards is 1¾ inches less than the distance between sides of girders, and the width of the panel is 1¾ inches less than the distance between sides of beams. This leaves ⅞ of an inch all around, for fillets, shown in Figure 20. The length of the joists should be about 4 inches less than the distance between faces of beams. A 1-by-6 ribband is nailed to the under side of the joists, parallel to the beam and next to the ledger strip, after the panel is set into its exact position. This holds the panel in place.

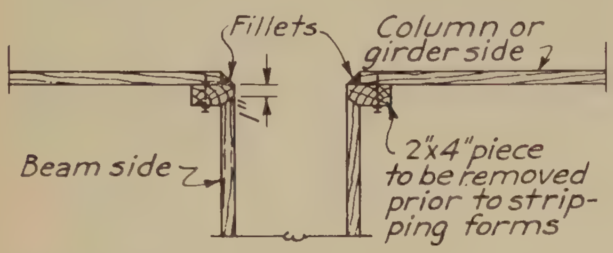


FIGURE 21 - PLAN SHOWING USE OF 2"x4" AT ENDS OF BEAM SIDES

The relation between the floor panels and the beam forms is well illustrated in Figures 19 and 20.

Use of Fillets

We invariably make use of fillets, generally ⅞-inch, in all corners of slabs, beams, girders and columns. Fillets cover up the imperfections that might otherwise show up where forms do not fit perfectly. They also serve the useful purpose of preventing leakage of mortar at corners.

Changing Forms When Column Sizes Change

Much work is involved in changing forms to conform to changes in column sizes, which too frequently occurs at intervals of one or two stories. It were well if designers were more inclined to maintain the same column size throughout a greater number of stories than usual.

A change in column size means a change to a smaller size. Forms for girders and beams framing into columns may be lengthened by extending each end of the sides and the bottom plank with a short piece of width equal to half the change in column size. These extension pieces should be held in place by scabs nailed securely with double-headed nails, so that the pieces may be replaced with wider pieces when the column size is again reduced.

The floor form panels may also be built out with extension pieces held in place by scabs, but it is difficult to hold them in true position. Frequently it is better to remove the boards affected, cutting off and wasting the previously notched-out part, cutting out new notches to conform to the new column lines, then replacing the boards. The re-cut boards will now be too short, so they must be cut in two, each part placed into proper position and the gap near mid-span filled in with short pieces.

This article deals especially with the type of slab-beam-girder floor described in the first paragraph. Whatever may be said in favor of this type, it has the disadvantage of requiring a large amount of form lumber. Where the beams are smaller and much closer together, metal forms are used to eliminate much of the lumber, or combinations of tile-and-joist floor construction are employed. These special products and the methods of using them are illustrated in the catalogs of manufacturers, and need not be discussed further except to show an isometric view of a floor with metal forms set in place, in Figure 23.

FIGURE 22 - SPACING OF JOISTS, IN INCHES, FOR FLOOR FORM PANELS.

SIZE OF JOIST	CLEAR SPAN IN FEET	THICKNESS OF CONCRETE SLAB, IN INCHES													
		2½	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9
2"x6"	5	27	27	27	27	27	27	25	24	23	22	21	20	19	18
	6	27	25	23	21	20	19	18							
	7	20	18												
2"x8"	6	27	27	27	27	27	27	27	27	27	27	26	24	23	22
	7	27	27	27	27	26	25	23	22	21	20	18			
	8	27	25	23	21	20	19	18							
	9	21	19	18											
2"x10"	8	27	27	27	27	27	27	27	26	25	24	22	21	21	20
	9	27	27	27	26	25	23	22	21	19	18				
	10	26	25	23	21	20	19	18							
	11	23	21	19											

Note:- The above table is based on use of ⅞" form boards, which accounts for the maximum joist spacing of 27 inches. Heavier floor boards would permit greater joist spacing but would add greatly to the weight of the panels.

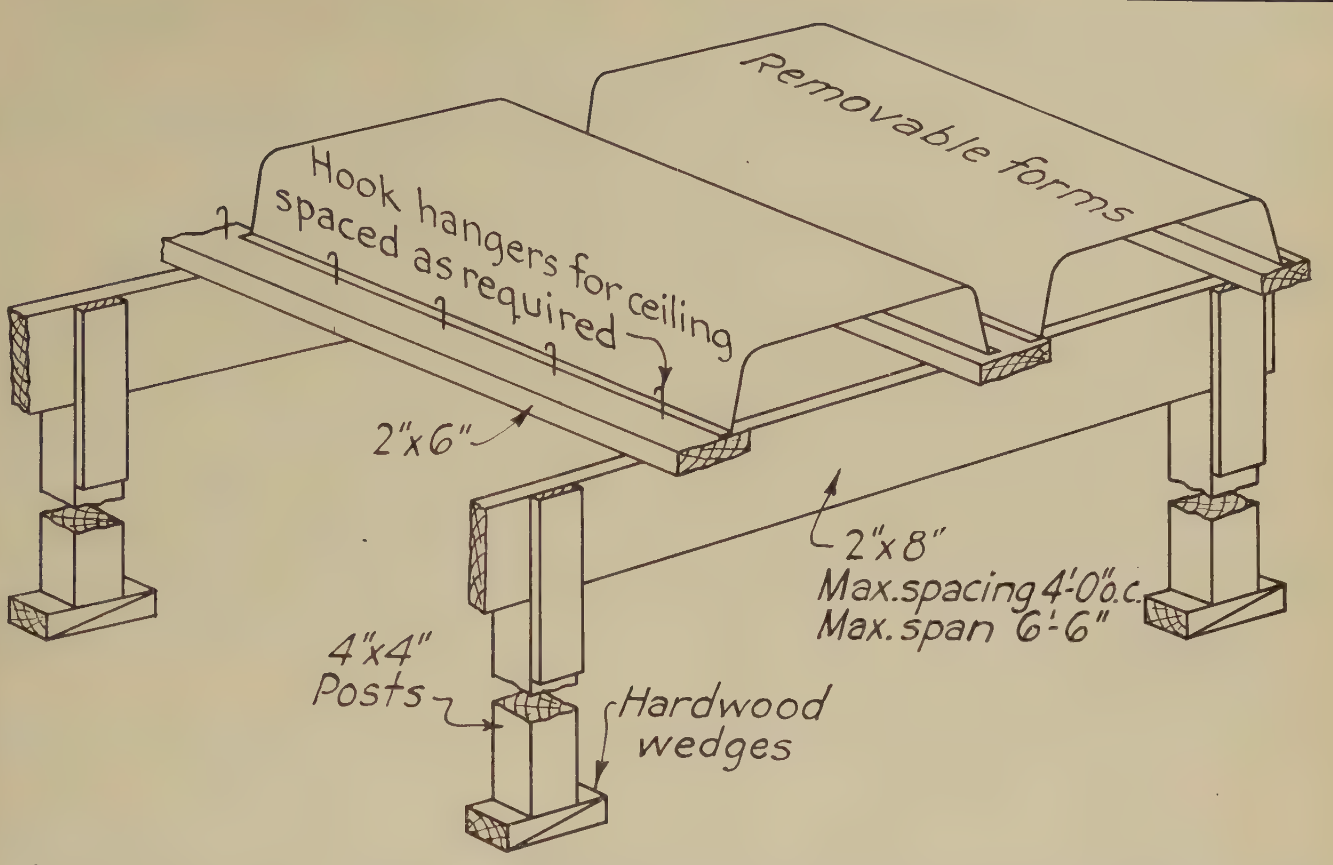


FIGURE 23 - SPECIAL METAL FORMS FOR JOISTED FLOOR CONSTRUCTION

Shoring the Floor Construction

It will not be out of place here to set forth a few of the principles to be followed in shoring the floor form construction. We make it a practice to support beam and girder forms on jack frames, illustrated in Figures 19 and 20, made up essentially of a 3-by-4 post, a 3-by-4 T-head, or jack head, across the top, with braces and scabs to make a rigid unit. These are spaced 6 feet or less along the beam. Final adjustments of form levels are made with wedges. In the use of these shores, or jack frames, the following precautions should be observed:

(1) If the shores are more than 8 feet long they should usually be stay-braced from post to post.

(2) The shores in the story being concreted should be directly above the shores in place in the story below.

(3) Shores must be set plumb and ends of posts must be cut square to prevent collapse.

(4) Splicing of posts should be avoided; but if unavoidable, see that the abutting ends are cut square and have full bearing, and that the two parts are in line.

Re-Shoring

It is customary to remove parts of the form work, such as floor panels and beam and girder sides, as soon as this may be done with safety, in order to re-assemble and use them on the next floor above.

The bottom planks of the beam and girder forms, however, are left in place a considerably longer time until the concrete is hardened. But in order to have the use of the built-up jack frames shown in Figures 19 and 20 we replace them with 3-by-4 posts set as near as possible to them. The new posts are tightened into place with wedges, after which the wedges over the jack frames are released and the frames are removed and used on the next floor. The bottom planks, being left in place, can be depended upon to distribute the load along the beam.

Stripping

The time for stripping cannot be stated in an exact number of days, but under ordinary warm weather conditions, or when the work is well protected against cold weather and is kept warm, all except the bottom planks and the reshoring posts may be removed the third day after the floor is concreted.

The following procedure, which may be understood better by referring to Figure 20, should be followed in stripping the forms:

(1) Remove the double-headed nails holding the bottom planks to the beam and girder sides.

(2) Remove the 3-by-4 liners along the girder.

(3) Block up the floor panels temporarily with 3-by-4 posts set on the floor below.

(4) Now remove the 1-by-6 ribbands and the short 2-by-4's at the ends of beam and girder sides, and take down the beam and girder sides.

(5) Let one edge of each floor panel down on the T-heads of a row of jack frames. Remove the jack frames along the other edge, after replacing them with re-shoring posts, then take the floor panel down. Do not let the panel drop to the floor below, but let it down without shock.

(6) Remove the remaining jack frames, after setting reshoring posts next to them.

Large Volume of Contracts in All Groups Except Buildings

An unprecedented volume of concrete pavement awards for this season, a big increase over 1929 in contracts let by public works departments and public utilities, and a slight increase in contemplated construction compared with February, 1929, are the favorable factors that are offset by the continued lagging in contracts for new building construction.

Concrete Pavement Awards Nearly Double the 1929 Figures

Actual contracts awarded for concrete roads and pavements from January 1st to March 15th are nearly double the figures for the corresponding period of 1929, according to tabulations made by the Portland Cement Association. The month of February saw 6,886,805 sq. yd. of concrete pavements awarded, compared with 3,241,179 sq. yd. in February, 1929. During the first half of March, 1930, the awards totalled 7,637,546 sq. yd., compared with only 2,952,765 sq. yd. in the first half of March, 1929. Total contracts for concrete pavements awarded up to and including March 15th and the corresponding figures for 1929, are as follows:

SQ. YD. AWARDED, JAN. 1ST TO MARCH 15TH

Roads	8,781,453	16,976,783
Streets	3,866,009	3,931,718
Alleys	141,059	210,427
Total sq. yd. awarded	12,788,521	21,118,928

From the foregoing figures it is evident that state and county highway departments are making a splendid record toward getting their 1930 construction programs under way, but that the public works departments of cities are only slightly in advance of last year with their street and alley paving programs.

Construction Contracts Holding Up Well

The F. W. Dodge Corporation reports a substantial increase in contracts awarded by public works departments and public utilities during February, compared with February, 1929, but a decrease in contracts for new buildings, bringing the total for the month somewhat below February of last year. In contemplated construction work February shows a small increase over the corresponding month of 1929, a fact which promises a big volume of contracts in the near future. The Dodge figures for contracts awarded are:

CONTRACTS AWARDED IN FEBRUARY

	1929	1930
Buildings	$303,680,900	$231,228,100
Public works and public utilities	57,593,000	85,824,900
Totals	$361,273,900	$317,053,000

CONTRACTS AWARDED IN FIRST 2 MONTHS

	1929	1930
Buildings	$647,126,800	$443,138,100
Public works and public utilities	124,115,000	197,890,100
Totals	$771,241,800	$641,028,200

The February figures for contemplated construction, as previously stated, are slightly in excess of last year. The total is made up of $537,021,600 for contemplated building construction and $243,756,800 for the construction programs of public works departments and public utilities. The totals follow:

	Contemplated Construction
In February, 1930	$780,778,400
In February, 1929	772,621,600

Many things occurred during the month of March to give support to the belief that the revival of construction work is well under way.

First came the announcement that shipments of portland cement were larger in February than in any other February in the last four years. This was followed by the announcement that the tonnage of unfilled orders for structural steel showed a slight increase on March 1st, as compared with February 1st, whereas a decrease had been expected. The unfilled orders exceeded those of March 1, 1929, by 335,000 tons, and were in fact the highest for the season since 1926.

Next came the statement of the federal government that the peak of unemployment had passed and that general business conditions were on the upgrade.

On March 10th one of the largest manufacturers of construction equipment announced a new high record of unfilled orders on the company's books.

Finally, on March 24th, came the passage of the Senate tariff bill, which gave encouragement to the hope that the unsteadying influence of the troublesome tariff question will soon be removed.

New Decision Sustains Straub Cinder Patent

A new decision sustaining the Straub cinder block patent No. 1,212,840 was handed down by the Hon. Morris A. Soper, judge of the federal district court at Baltimore, Maryland, on March 13.

The suit, entitled "Crozier-Straub, Inc., versus The Maryland Corporation," was defended on the ground that manufacturing operations were conducted under another patented process and that cinders were separated into coarse and fine and then recombined in the mixer. It was claimed that this was not a violation of Straub teachings.

The Court held otherwise, the evidence showing that the constitutency of the aggregates was the same as if they had been used without separating and recombining.

The decision is in the Fourth Circuit, previous favorable decisions on this patent having been in the Third Circuit.

A. R. E. A. in Thirty-First Annual Convention

The American Railway Engineering Association held its thirty-first annual meeting at the Palmer House, Chicago, on March 11th to 13th, inclusive, coincident with the annual railway exhibit in the Coliseum in the same city.

Adoption of a standard specification and formulas for the design of reinforced concentrated loads was the outstanding point of interest to designers of bridges and buildings. This specification will comprise a valuable addition to the A. R. E. A. specification manual.

G. D. Brooke, general manager of the Chesapeake & Ohio Railway, Richmond, Va., was elected president of the association for the coming year.

Short Design Course for Kansas City

A three-day short course in design and control of concrete mixtures is scheduled to be held April 14th, 15th, and 16th in the Grill Room of the Baltimore Hotel, Kansas City.

Application of Trilinear Charts to Aggregate Grading Control

Aggregate Grading Control in Stucco Plants Simplified by Use of Trilinear Charts—Much Easier Than Trial Batch Method—How Sieve Analyses of Aggregates Are Plotted—Practical Applications of Method

By **THEODORE E. SHEAFER**
Specialist in Stucco and Plaster Products

THE trilinear form of chart lends itself admirably as a means of controlling aggregate grading in plants manufacturing stucco products. In such plants a well graded aggregate of constant uniformity is of prime importance in manufacturing a finished product of unvarying color and performance. A characteristic of the trilinear chart is that it permits a quick determination of the proportion of two or three sands of different gradings required to produce an aggregate grading suitable for the manufacturer's use.

Method Easy to Use

No mathematical knowledge other than the ability to plot the results of a sieve analysis, to measure the length of a few lines with a ruler, and to use simple arithmetic, is necessary to arrive at results which if attempted by means of trial methods would require almost endless patience and loss of time.

The trilinear chart also has another application of considerable commercial value, and that is the selection of suitable aggregates from the viewpoint of economy. A problem of this nature and its solution will be given later in this article after the manner of using trilinear charts has been explained.

Method of Reading Charts and Plotting Sieve Analyses

The method of plotting a trilinear chart is most readily explained by an example. Suppose we have four different gradings of sand, indicated by a, b, c and d in the following table, which gives the sieve analyses for each.

	Sample			
	a	b	c	d
Sieve Size	Per Cent by Weight			
Passing No. 14, retained on No. 28	30	50	10	30
Passing No. 28, retained on No. 100	50	30	30	10
Passing No. 100	20	20	60	60

Figure 1 is labeled to correspond with the three sieve sizes determined in the above sieve analyses. The left hand side of the triangle is labeled "Per Cent Sand Passing No. 14 Sieve, Retained on No. 28." From the sieve analysis it was determined that 30 per cent of sample (a) was retained on a No. 28 sieve and therefore the point representing the sieve analysis of this sample lies somewhere on the 30 per cent line marked off by the scale on the left hand side of the triangle. This line has been arbitrarily labeled OP and drawn heavy for sake of reference in this example. Exactly where the point representing the sieve analysis of sample (a) lies on this line cannot be determined until the next sieve size of the sample is plotted.

According to the sieve analysis 50 per cent of sample (a) passed a No. 28 sieve and was retained on a No. 100 sieve. On the right hand side of the triangle is a scale labeled "Per Cent Material Passing No. 28 Sieve, Retained on No. 100." Somewhere along the 50 per cent line marked off by this scale lies the point representing the sieve analysis of sample (a). This line has been labeled LM and also drawn heavy for reference.

Since the point representing the analysis of sample (a) lies on both line OP and line LM, the only place possible would be at the intersection of these two lines. This fixes the point on the trilinear chart in Figure 1 which represents the sieve analysis of sample (a). The point may be checked by plotting the per cent of material passing No. 100 sieve. According to the sieve analysis this was 20 per cent; and referring to Figure 1 it is seen that the line representing 20 per cent of material passing No. 100 sieve passes through point (a).

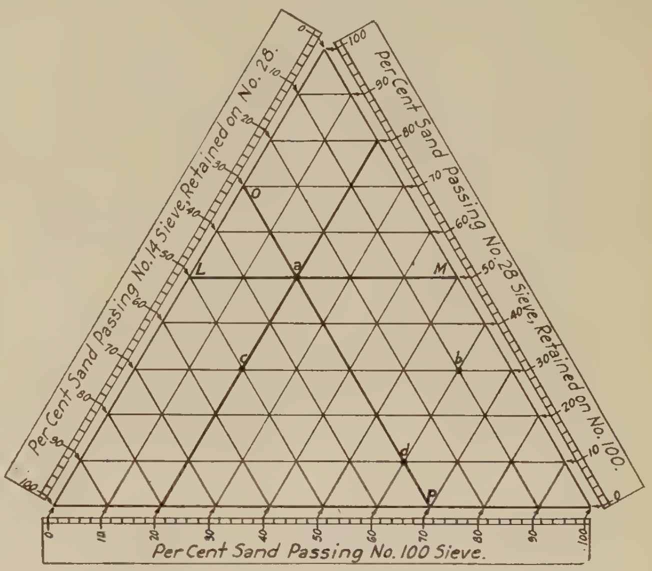


Figure 1. Showing method of plotting results of sieve analyses of aggregates

In other words, the point representing the three respective values obtained in the sieve analysis sample (a) is located where the three lines intersect and gives the grading of the sand under consideration. The points representing the grading of samples (b), (c) and (d) were located in like manner.

Calculation of Aggregate Proportions

The method of plotting values has now been described and the application of trilinear charts to aggregate grading control is here given in the form of a typical example. This practical application of trilinear charts was originally suggested by Professor Feret in the Annales des Ponts et Chaussees, 1892, for the purpose of investigating the strength of concrete mixtures containing sands of different gradings.

Suppose a manufacturer has selected an aggregate grading, denoted in Figure 2 as S, which he considers has all the requisites necessary to aid in the production of a reliable, well balanced stucco. He desires to maintain this grading constant over a long period of time in order to produce a uniform finished product. By carrying in stock three sands of different grading, namely, a coarse sand (C), a sand of medium fineness (M), and a very fine sand (F), he can control the grading of the combined sand (S) by selecting the proper proportions of the three sands he carries in stock according to the methods here described.

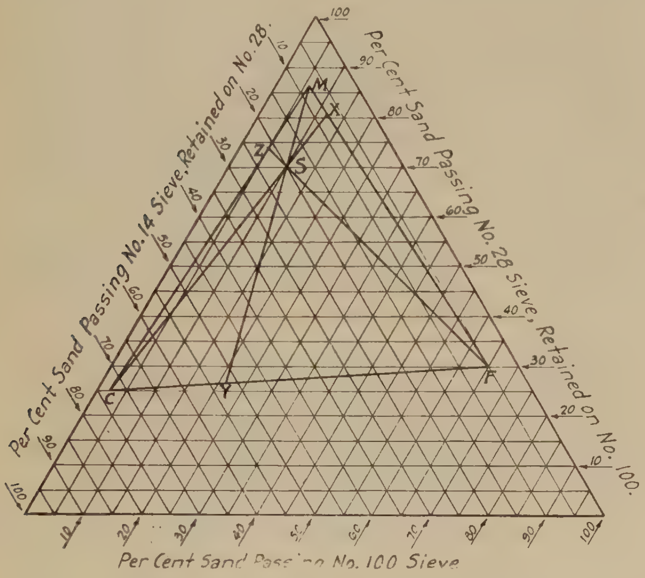


Figure 2. Method of determining quantities of available fine, medium and coarse sands to obtain combined mixture of any grade desired

A sieve analysis of the three sands in his bins gave the data in the following tabulation, in which (S) indicates the desired grading to be obtained from these sands.

Sieve Size	C	M	F	S
	Sample			
	Per Cent by Weight			
Passing No. 14 sieve, retained on No. 28	73	8	5	20
Passing No. 28 sieve, retained on No. 100	25	86	30	70
Passing No. 100 sieve	2	6	65	10

These data were then plotted on a trilinear chart as shown in Figure 2 and lines drawn connecting the points to form the triangle CMF. Lines were then drawn from C, M and F through S and intersecting the opposite sides of the triangle at x, y and z respectively.

To determine the percentage of coarse sand (C) required in the mix a ruler or other suitable measuring device is used to measure the distance between the points Sx and Cx. The value obtained for Sx is then divided by the value determined for Cx, and multiplied by 100. This gives the actual percentage of coarse sand required in the aggregate (S). The same procedure is repeated for lines Sz and Fz and lines Sy and My to ascertain the percentages of fine sand and medium sand required for aggregate (S).

In order to clarify the above statements the actual example as shown in Figure 2 is worked out in the following steps. In the reproduced drawings, and with a different measuring device, the measurements will be represented by different values but the ratio between the values will of course be the same as in the example that follows:

(1) $\frac{\text{Sx}}{\text{Cx}} \times 100 =$ per cent, by weight, of coarse sand required.

Substituting values obtained by actual measurement—

$\frac{0.88}{4.7} \times 100 = 18.8 =$ per cent, by weight, of coarse sand required.

(2) $\frac{\text{Sy}}{\text{My}} \times 100 =$ per cent, by weight, of medium sand required.

Substituting values obtained by actual measurement—

$\frac{2.41}{3.30} \times 100 = 73.0 =$ per cent, by weight, of medium fine sand required.

(3) $\frac{\text{Sy}}{\text{Fy}} \times 100 =$ per cent, by weight, of fine sand required.

Again substituting values obtained by actual measurement—

$\frac{0.275}{3.35} \times 100 = 8.2 =$ per cent, by weight, of fine sand required.

Each new shipment of aggregate received should be analyzed for grading, plotted on a trilinear chart and proper proportions of each grade calculated as described above.

By employing this system of control the manufacturer of stucco products will be able to maintain an aggregate of constant grading in his stucco even though a variation occurs from time to time in any one or all of the sands he carries in stock.

Economic Application of System

As previously mentioned, trilinear charts may be used to select suitable aggregates from a viewpoint of economy. For example, a certain manufacturer of stucco is scientifically proportioning and combining three grades of sand to obtain an aggregate grading which he considers satisfactory for his purposes. To accomplish this he is mixing a coarse sand costing him $4.50 per ton delivered, a medium sand at $2.50 and a fine sand at $2.00. He has the opportunity to contract for another sand (not as coarse as the coarsest grade he now uses) at $3.50 per ton delivered. Before making the new contract he should know the answer to the two questions following:

(1) Can he substitute this sand for the more expensive grade and still by any possible combination of the three sands maintain his standard grading?

(2) If this is possible can he save any money by making the change?

The manufacturer's present standard aggregate grading and the three sands he combines to obtain this grading are the same as given in the problem worked out and illustrated in Figure 2. Bearing in mind the per cent of each of these sands he uses to obtain his standard grading the raw material cost per ton of these standard sands is calculated as follows:

18.8% of coarse sand at $4.50 per ton =	$0.85
73.0% of medium sand at $2.50 per ton =	1.82
8.2% of fine sand at $2.00 per ton =	0.16
Total cost per ton of standard aggregate =	$2.83

Figure 3 shows the grading of the sand C′ which was substituted for the coarse sand (C) plotted in Figure 2. As long as the point S denoting the standard or desired grading falls within the sides of the triangle formed by joining the points which represent the grading of the three sands to be combined, it is possible to obtain the standard grading from these sands. It is immediately seen therefore that the manufacturer can combine the new coarse sand under consideration with the two sands he has in stock to obtain his standard grading S.

The next question is whether the substitution of this new sand, costing him $3.50 per ton, for the sand costing $4.50 per ton is going to save him money. The proportion of each sand necessary to produce a standard grading is first calculated in the manner used in calculating the data given in Figure 2, or the cost may be determined directly in one operation as follows:

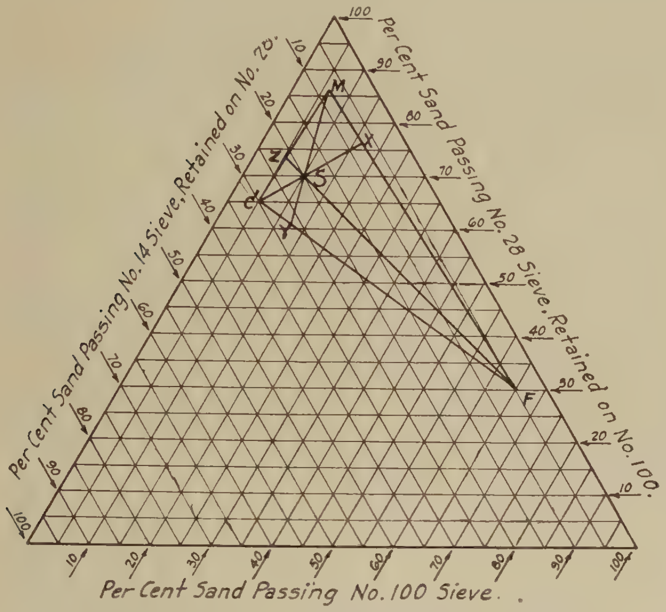


Figure 3. Analysis of possibilities of a less expensive coarse sand

$$\frac{Sx}{C'x} \times \text{Cost per ton of coarse sand} = 0.565 \times \$3.50 = \$1.98$$

$$\frac{Sy}{My} \times \text{Cost per ton of medium fine sand} = 0.352 \times \$2.50 = 0.88$$

$$\frac{Sz}{Fz} \times \text{Cost per ton of fine sand} = 0.083 \times \$2.00 = 0.18$$

$$\text{Total cost per ton of standard aggregate} = \$3.04$$

Actually, therefore, although the manufacturer has an opportunity of buying a substitute sand at $1.00 per ton saving, with which he can obtain his standard grading by proper proportioning, it will cost him 21 cents per ton more to obtain the standard grading with the less expensive sand. The trouble lies in the fact that more of the new sand is needed to produce the required grade of combined sands.

Conclusion

The particular gradings used in this article as examples need not be adhered to. The charts are applicable to any three gradings which the reader may select and which he considers the most suitable in controlling the grading of aggregate he is using.

The accuracy of calculations made with trilinear charts depends largely upon the pains taken in measuring the distances between the points plotted. With average care, a control of aggregate close enough for all general purposes can easily be maintained.

Building Officials' Conference in Sixteenth Annual Meeting at Cleveland

The Building Officials' Conference of America held its sixteenth annual meeting at the Hollenden Hotel in Cleveland from March 24th to 28th, inclusive. The program included a number of papers pertaining to the problem of city building inspection departments and to the use of various building materials and types of construction. Several inspection trips were also included.

Among the papers of special interest to the concrete construction industry and the concrete products industry was one on the subject of "Building Regulations for Reinforced Concrete," by M. J. McMillan, of the Portland Cement Association's Chicago office. Another paper of interest comprised a report of the Committee on Hollow and Solid Building Units, presented by Frank H. Alcott, of the National Lumber Manufacturers Association. Frank Burton, consulting engineer of Detroit, and for many years commissioner of the Department of Building of that city, presented two papers, one on "Fire-Resistive Construction" and another entitled "An Enabling Act to Permit the Adoption of National Standards." The last-named subject is one of increasing interest to writers of building codes as well as to building inspection officials, because of the constantly increasing number of national standards being made available. The adoption of such standards by reference is legal in some states either by a specific state law or on the strength of court decisions, while in other states much difference of opinion prevails regarding the legality of such procedure.

Additional papers of interest included one on the subject of "Methods of Construction and Use of Materials," by Edward W. Roemer, supervisor of construction for the city of Boston; one on the subject of "Mortars and Masonry," by C. E. Ellsworth, of the National Lime Association; a paper on the "Relation of Building Codes to Fire Prevention Codes," by Clinton T. Bissell, associate consulting engineer for the National Board of Fire Underwriters; and one on "Building Code Provisions for the Use of Concrete," by Col. John W. Oehmann, inspector of building for the District of Columbia.

The main sessions of the convention were closed with the sixteenth annual banquet. In compliance with the rules of this organization, the location for the 1931 convention will be selected at a later date by the executive committee.

1929 Value of Canadian Building Permits Establishes Record

The value of building permits authorized in 61 Canadian cities during 1929 amounted to $234,944,549, creating a record since the statistics were first collected in 1920. The index of wholesale prices for building materials was 99, based on 100 for 1926. As compared with 1928, the value of building permits increased 7 per cent and all provinces except Ontario registered gains, the largest absolute increases being in Quebec and Alberta.

Testing Cement Colors

Six Tests to Determine Suitability of Colors for Use in Concrete—Classified Storage of Sample Advised

COLORED concrete gives very satisfactory results provided the mineral colors used in its manufacture are suitable for mixing with cement. Staining power, fineness, freedom from efflorescence, and light resistance must also be considered. Since the average products manufacturer has no chemist on his staff or laboratory at his disposal, he is often entirely dependent on his supplies.

The following reliable tests will enable even the smallest manufacturer to find out the suitability or otherwise of colors offered to him.

Test for Contraction

(1) Thoroughly mix one part of color with two parts of cement in their dry state. Add distilled water and stir until a quaky consistency is obtained. Put about two teaspoonfuls of this mixture on a piece of glass, slightly vibrate the glass to cause the mixture to spread out a little, and then allow it to harden in the air for 24 hours. Then place it under water and leave it there to harden further. If cracks appear in the pat it is proof that that color is useless for mixing with cement.

(2) Put 2 oz. of dry color in a medicine bottle. Add enough distilled water to make a creamy fluid, and shake thoroughly. A suitable color will not float on top of the water, but will mix readily with it. Now pour half the contents of the bottle on to a glass plate. To the remainder in the bottle add ¼ oz. of chloride of lime. Shake again thoroughly and pour on to another glass plate. Watch both pats to see whether the addition of chloride of lime has made any great difference to the color, i. e., whether it has caused it to become paler or mottled. If so, the color is useless for cement.

Test for Staining Power

(3) To find the staining power of color and to compare it with others, mix a small quantity of each color with, say, ten times the quantity of cement. To mix it thoroughly pass it several times through a hair sieve and then put it on a glass plate, marble slab, or slate. Pat it down with a small trowel until no streaks are visible and the whole mixture is of a uniform shade. Then add to each mixture sufficient water to make it into a soft paste when thoroughly mixed. Place some of each on a metal plate and dry it out over a flame or in an oven; then compare results.

It is essential that cement colors should be of at least the same fineness as cement. The finer ground the color the greater will be its staining power, and the greater can be the proportion of cement added to it.

Test for Fineness

(4) Apart from testing with fine sieves, another useful test is as follows: Take a small flower pot or cup, half fill it with dry color, add distilled water and stir thoroughly. Allow the color to settle firmly; then draw off the water and allow the color to dry and harden. Gentle artificial heat may be employed for this purpose. On breaking the dry pat of color and inspecting the fractured part with a magnifying-glass, it may be found that some coarser materials have settled at the bottom, leaving a finer layer at the top. This will not be the case if the color is finely and evenly ground. If the fractured surface shows variations in color, or if it cannot easily be crushed between the fingers, it shows that the color contains foreign matter and should be condemned. The same applies if when putting a few drops of spirits of salt on the fractured surface the result is the same sizzling sound that occurs when spirits of salt is poured on concrete. In that case, very probably chalk has been added to the color to cheapen it. An addition of chalk also makes the color lumpy. Should the pat show signs of efflorescence after drying it proves that the color contains alkaline salts and is therefore unsuitable for use with concrete.

(5) Mix dry color with distilled water until it is a stiff paste. Put it on a glass plate and press another glass plate over it so that there is only a thin layer of colored paste about ⅛-in. thick between the two. Stick some adhesive tape or paper round the edges of the two plates, joining them together. Paste a circle or cross made of black paper on top of one plate so as partly to cover that side. Then expose it to the sun or artificial sunlight for about a week or longer. If the color is not light-resistant a contrast between the covered and uncovered part will be noticed as soon as the black paper is removed from the glass.

Test for Aniline

(6) The presence of aniline in cement color is one of the principal causes of it not being light-proof. Aniline, however, can easily be found by placing a little of the color in each of three test tubes (obtainable from any chemist for a few pence), one containing water, one turpentine, and the third alcohol. Each should be shaken thoroughly and then allowed to settle. If the color settles at the bottom and leaves the clear fluid above in all three tubes, then the color does not contain aniline. If, however, one of the fluids remains colored, even if only slightly, the color should not be used in conjunction with cement.

In conclusion, the writer advises products manufacturers always to take a small sample of color directly a cask or package is opened, place it in a small airtight container (a medicine bottle will serve the purpose very well) and label it, stating the number of the color, the source of supply, and the date of delivery. Later should be added the date when the color was first used, and finally the date when the last of it was used. This sample should be carefully stored for future reference. It is a little precaution that may save much trouble in the future.—R. H. B.

Getting Brick Colors with Colored Sands

Brown and red sands are being used by the Acme Brick Company, manufacturers of face and common concrete brick at West Berlin, N. J., to obtain desirable colors in the finished product. The Acme plant was recently completed, having been organized with a capital stock of $125,000. E. V. Robinson, former owner of the Robinson Lumber Co., Berlin, N. J., is president of the Acme Brick Company.

Reprinted from *Cement and Cement Manufacture*, issue of January, 1930.

American Concrete Institute

Building Regulations for Reinforced Concrete Adopted by 100 Cities

Architects and Structural Engineers Urged to Obtain Adoption in All Cities for Sake of Uniformity—Handbook for Designers Adds to Value of Regulations—Principal Features Enumerated and Discussed

By M. J. McMILLAN
Structural and Technical Bureau, Portland Cement Association

THE standard building regulations for the design and construction of buildings of reinforced concrete, sponsored by the American Concrete Institute, have been adopted by more than 100 cities throughout the United States, and the largest two cities now have new building codes in the making in which these same regulations are used, with only minor modifications, as the chapter on reinforced concrete.

The regulations sponsored by the Institute were prepared by nineteen men who are recognized as authorities in the field of reinforced concrete design and construction. In drawing up the regulations the members of the committee used all test data available, supplemented with their many years of experience. The safety of design was the first consideration; economy was second. It developed that a logical and safe design was also an economical design.

The purpose of these regulations is to establish a uniform, safe and economical standard for all reinforced concrete construction, to present in codified form specifications for reinforced concrete work that could be used verbatim as a chapter on reinforced concrete in a general building code.

A. S. T. M. Standards of Quality Required

These regulations for reinforced concrete require all materials to meet the standard specifications of the American Society for Testing Materials. Also, in the sections on Materials and Tests there is a standard load test to be used when so ordered by the building inspector. This provision is omitted quite frequently in building codes, while others specify tests that are entirely unreasonable. Unreasonable requirements for any materials will more or less eliminate their use and create an unhealthy condition in the industry. Just recently my attention was called to a section in a proposed building code which, if enforced, would make it possible to build only one concrete pile every 28 days and then subject it to a load test for two weeks.

Assumed Strength on Sound Basis

The working stresses for the design of reinforced concrete are based upon the minimum ultimate 28-day compressive strength of the material. The strength is fixed in terms of the ratio of water to cement in two ways. First, by the results established for average materials and, second, by specific test of the materials which are to go into the structure. The water-cement ratio control has been accepted all but unanimously by the newer building codes. The old arbitrary mix, such as 1:2:4, which was assumed to be 2,000-pound concrete, has gone by the board. The building inspection official of today should be interested only in the ultimate 28-day strength of the concrete and not whether the mix is 1:2:4, 1:1½:3 or some other arbitrary proportions.

It has been generally accepted that it is now possible to design concrete mixtures scientifically and not by guesswork; the range in strength obtained on actual jobs can be confined between limits much narrower than was formerly possible. A mixture can now be designed to meet a predicted strength very closely.

Working Stresses for Reinforcing Steel

The allowable unit stresses in reinforcing steel are 20,000 pounds per square inch for intermediate grade billet steel or rail steel bars; 16,000 for web reinforcement and 18,000 for structural steel shapes used as concrete reinforcement.

When higher working stresses for reinforcing steel were first advocated it caused some comment. I remember a conversation with a member of a building code committee who was not altogether sold on the idea of these higher stresses. This gentleman made the statement that he would be in favor of raising the allowable steel stresses to 18,000 pounds per square inch in the new code, but since the old code called for an allowable stress of 16,000 pounds he felt that this increase would be a decided concession. He was of the opinion that in allowing a 2,000-pound increase the strength of the concrete would be impaired and the factor of safety reduced. His reaction was a most natural one because he was not acquainted with all the facts in the case.

Steel Stress No Departure from Former Practice

The use of a 20,000-pound allowable unit working stress for the intermediate grade of steel reinforcement is entirely logical. According to the A. S. T. M. "Standard Specification for Billet Steel Concrete Reinforcement Bars" the minimum yield point allowable for structural grade steel bars is 33,000 pounds per square inch. On the 16,000-pound stress allowed for many years in the older building codes the factor of safety was about 2. Now for the intermediate grade of steel bars, the A. S. T. M. specifies a minimum allowable yield point of 40,000 pounds per square inch. With a maximum allowable unit working stress of 20,000 pounds per square inch, the

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Abstract of paper read before Sixteenth Annual Meeting of the Building Officials Conference of America, Cleveland, O., March 27, 1930.

factor of safety is again 2. As a matter of fact, the actual yield point of this latter grade of steel runs between 44,000 and 48,000 pounds per square inch, which provides a factor of safety between 2.2 and 2.4. For rail steel bars the A. S. T. M. specification requires a minimum yield point of 50,000 pounds per square inch.

In reality all that has been done is to specify a higher working stress for a better grade of steel, which will give us the same factor of safety or a larger one. This is going to reduce the amount of reinforcement required, and because the costs for the various grades of steel are practically the same, it will reduce the cost of structures.

Combination Steel and Concrete Columns

In addition to the provisions for the ordinary concrete columns reinforced with either spiral hooping or lateral ties, the American Concrete Institute regulations provide for both composite and combination columns, which most building codes fail to provide for.

The composite column is one which has a concrete core enclosed by spiral reinforcement and is further reinforced by longitudinal bars, the whole of which encases a structural steel or cast iron column designed to carry a portion of the load.

The combination column is one which has a structural steel section, designed to carry the principal part of the load, wrapped with wire and encased in concrete of such quality that some additional load may be allowed.

Either the composite or combination type of column is one brought into use primarily in tall buildings. In a tall building columns of these types may be employed in the lower stories, while the upper stories will have columns of ordinary reinforced concrete. The use of this combination permits the dimensions of the finished columns to be the same in all stories from the top to the bottom. Girders framing into the columns are of the ordinary reinforced concrete type.

Designers of buildings will readily see the advantages of such combinations. The economy of reinforced concrete for the structural members of structures may be utilized in buildings of almost any height. Uniformity of column sizes from top to bottom simplifies form work not only for the columns but for the girders, beams and slabs framing into them, and the exterior spandrel walls as well. It also simplifies the placing of the interior trim and plaster work around columns because of the repetition of sizes.

The composite column and the advantages growing out of its use illustrates another case in which the intelligent design and use of structural materials may be employed in reducing the cost of large buildings without reducing their structural strength or safety. It is the duty of the building industry to find ways and means of producing building of better quality at lower cost, for only in this way can the volume of new construction be maintained.

Provisions for Monolithic Walls

Definite requirements are given in the A. C. I. Regulations for the minimum wall thickness based upon the unsupported height or width of the wall. Also a table is included giving the minimum wall thickness, in inches, based upon the story height for wall-bearing construction.

These requirements for monolithic walls did not originate with the committee of the American Concrete Institute. In reality they were taken from the Seattle, Washington, code which had been in use since 1924. In Seattle such walls have proved to be practical, safe, and economical.

A decided advantage to the city building inspection department is the general familiarity of architects and engineers with these regulations. The regulations were incorporated as a part of the "Handbook of Reinforced Concrete Building Design." Some forty thousand copies of this handbook have been distributed in the United States, which means that almost every designing engineer and architect has a copy of the regulations in his office. This means also that an architect or engineer doing reinforced concrete work in any city, other than his own, would be familiar with the requirements of that city's code if the Institute's regulations were in force there.

Remaining Cities Should Adopt Regulations

Architects and structural engineers in cities where the American Concrete Institute regulations have not as yet been adopted should take the initiative toward obtaining such adoption. Active co-operation with the city building inspection department will accomplish the desired results. Such action on the part of architects and engineers will aid in the trend toward uniformity and standardization in the building industry and the consequent elimination of waste.

National Cinder Products Men Elect Williston as Head

On February 26th, 27th and 28th, the annual convention of the National Cinder Concrete Products Association was held at Atlantic City, N. J. The members of this association are manufacturers of cinder block under the Straub patent.

The attendance reached a new high record, in that more than 80 members from the United States and Canada attended the meeting. Plants as far west as Denver, Colorado, were represented.

At the business session, M. B. Williston of Detroit was elected president, Harvey Porter of Baltimore and Dr. Klotz of Allentown, vice-presidents, and H. H. Longenecker of Philadelphia secretary and treasurer.

Einar Christensen, research engineer for the association, acted as chairman and opened the convention by presenting a paper on "New Data on the Fire Resistance of Cinder Units," describing recent research work undertaken by National Building Units Corporation. M. C. McNary of the Portland Cement Association presented a paper on "Volume Change and Allied Phenomena," followed by a general discussion of the behavior of cinder units. This session closed with a significant report by the research committee covering a survey of cinder block plants made for the purpose of determining the plant efficiency of today.

At the next session, N. B. C. Stiteler of Philadelphia opened a sales symposium dealing with the problems of selling, advertising, etc. Charles E. Covell, now general manager of National Building Units Corporation, introduced the subject of Weldcrete masonry and the Straub-Covell cinder unit which is being introduced by eastern plants. A new insurance policy against moisture penetration of Weldcrete created interest.

The last session was devoted to the future of the industry. The senior counsel of the Straub patent litigation, Charles M. Clarke of Pittsburgh, and the general counsel of National Building Units Corporation, Chas. L. Pierce, reported on the successful patent suits of the past year. F. J. Straub and Einar Christensen carried this discussion onto the subject of the future of the industry. Harvey Porter of Baltimore analyzed the problems now facing the industry and was unanimously supported when stating the policy of the association as that of unification to perpetuate the cinder unit industry as an organic whole.

Reinforced Concrete Design Simplified

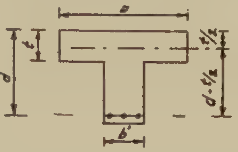
Chart K_1 (20,000)
Area of Steel, T-Beams

By JAMES R. GRIFFITH
Professor of Structural Engineering, Oregon State Agricultural College

American Concrete Institute Building Code

$f_s = 20{,}000$ lbs. per sq. in.

$$A_s = \frac{M}{20{,}000\,(d\,t/2)}$$



"CHART J—Choice of Steel for Slabs," as presented in the original series was not confined to any stress limitations. The same chart being applicable to this series, it will not be repeated.

Chart K, as originally explained, solved an approximation. This approximate method can be likened to the so-called "flange method" of figuring the strength of a steel girder. The resisting moment is a force couple. The compression force, of the couple, is considered as concentrated at the center of gravity of the T-beam flange. The tensile force, as with other types of beams, is considered to be concentrated at the center of gravity of the steel area.

Chart K_1 (20,000) is identical to the original Chart K (18,000) except that the central scale has been shifted to take account of the increased steel stress. Fig. 1-K_1 gives the details by which the original of Chart K_1 (20,000) was constructed. It will be noted that the construction isopleth was again taken through the values

$$(d - t/2) = 3$$
$$A_s = 0.2$$

The central scale in Chart K (18,000) had a value at the construction isopleth of

$$M = 10{,}800 \text{ in. lbs.}$$

In the present case, for a stress of $f_s = 20{,}000$ lbs. per sq. in., this has changed to

$$M = 12{,}000 \text{ in. lbs.}$$

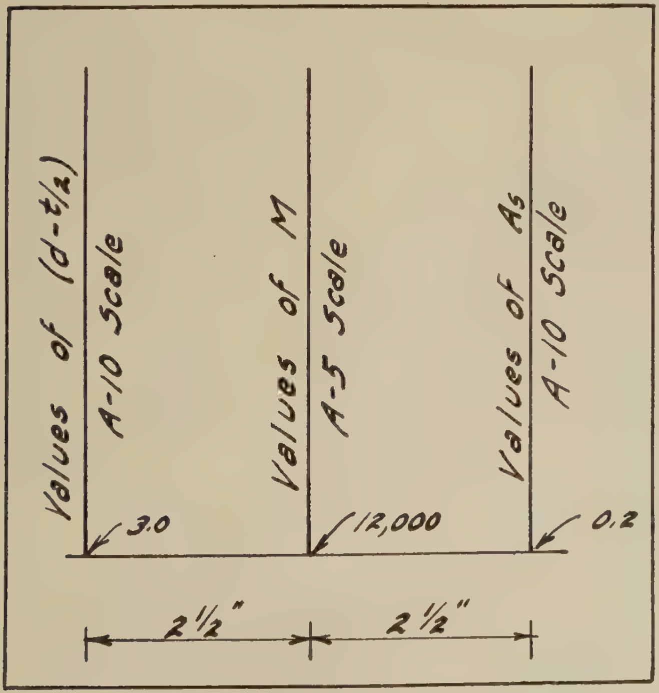


Figure 1-K_1

Chart L of the original series was designed to determine, approximately, the maximum compression stress in the flange of the T-beam. Since it was independent of any stress limitations it is applicable to this series as well. Chart L will therefore not be repeated.

New Transverse Testing Machine Designed

A portable transverse testing machine which weighs only about forty pounds but is capable of exerting a force of 4,000 lbs. has been designed for testing pavement concrete. Professor Herman C. Berry working in the engineering laboratories of the Towne Scientific School, University of Pennsylvania, designed the machine.

It satisfies all technical requirements for strength and accuracy and at the same time is light enough to permit an inspector to move it readily from one job to another, thereby avoiding delay in the testing and subsequent opening of new concrete roads, according to Dr. Robert H. Fernald, Dean of the Towne School.

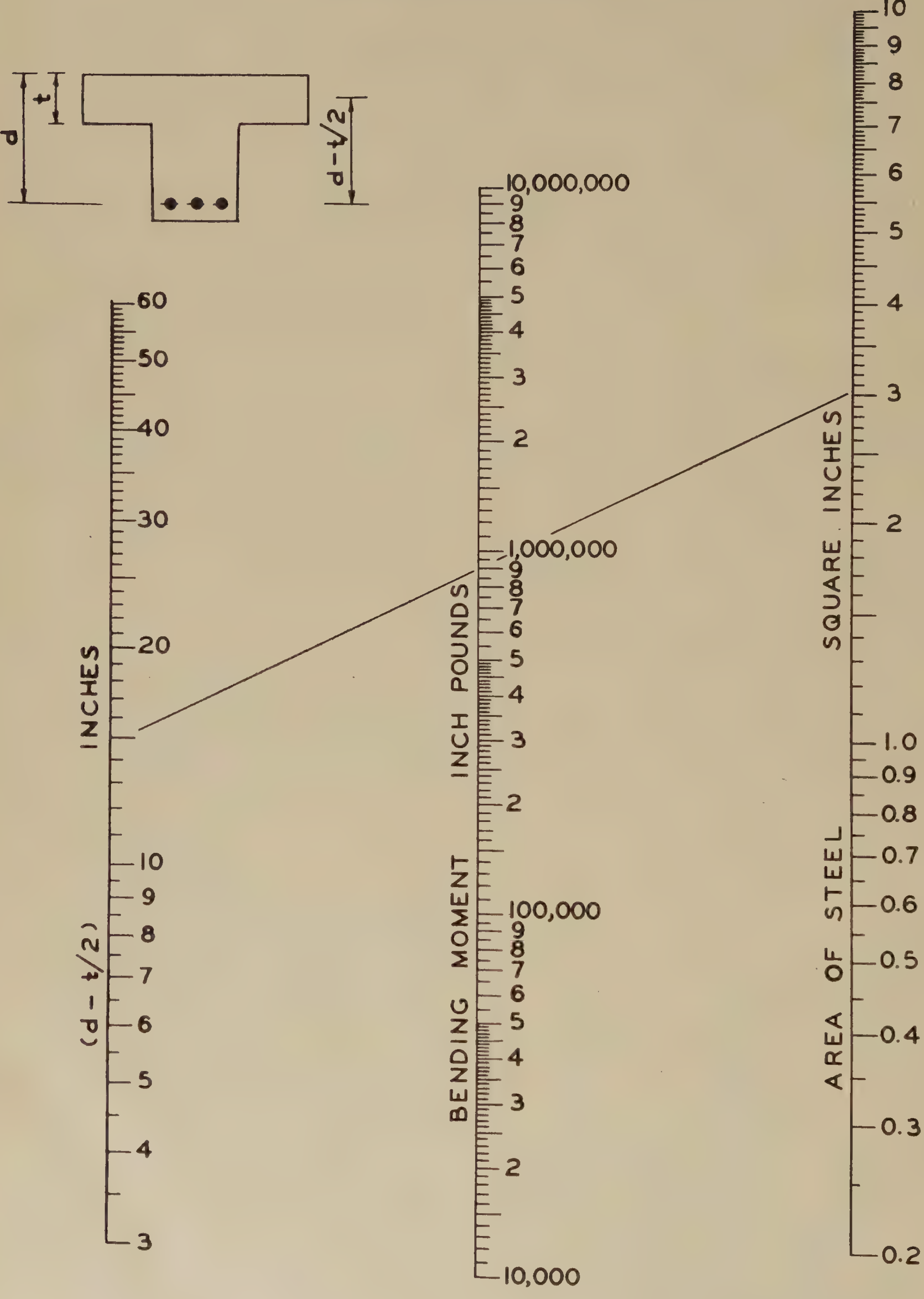
Mix Design Courses Popular in Iowa

Short courses in concrete mixing conducted during the winter by the Iowa State College of Engineering extension service and the Portland Cement Association were attended by 1,100 engineers, contractors and inspectors. The courses were presented in twelve Iowa cities.

CHART K$_1$ (20,000)

Area of Steel, T-Beams

$f_s = 20{,}000$ lbs. per sq. in.



National Silo Code of Ethics as Guide to Others

Rules of Fair Trade Practice Are Help to Many Industries —Established with Approval of Federal Trade Commission—Other Industries Considering Similar Action

Interest in the establishment of fair trade practice is growing.

Several industries comprising branches of the construction industry are now considering action in this direction.

As a guide to those engaged in the preliminary work of establishing a code of ethics, this code adopted by the National Silo Research Council will serve as a guide, for in general arrangement as well as in specific details these documents are much alike.

The sanction of the Federal Trade Commision is not the least of the advantages connected with the adoption of a code of business ethics.

DESTRUCTIVE competition is uneconomical, unethical, and may be unlawful. Long years ago the silo passed through the experimental stage and is now thoroughly tested and demonstrated to be of first importance to the stock farmer. In order to understand the economic value of the silo one must have a technical knowledge of the feeding subject. It is, therefore, necessary that we keep up our publicity service, making thorough study and research of all feeding experiments published by our institutions. We can best accomplish this by working together, for no one company alone could afford to engage such a service.

In order to work together we must treat each other fairly. This is beneficial to our business. It will bring about economy and saving, which in the end will mean profit. It is easier and wiser to tell the merits of our goods than to decry that of our competitor. To tear down our competitor is to tear down our own business. In the end, he who serves fairest and best will profit most.

The stock keepers of this country need 1,500,000 more silos, based on what some counties and states are actually using today. There are plenty of silo prospects. Every stock keeper without a silo is a good prospect, and is willing to pay a fair price for a good structure.

Preamble

Believing that it is beneficial to our industry and the trade we serve, to conduct our business in an efficient and economic manner, observing the ethics of good business, we here subscribe to the following fair trade-practice rules:

Rules for Fair Trade Practice

RULE 1. *Commercial bribery.* The paying or promising to pay to an employee of a customer or prospective customer of a commission or consideration of any character for the purpose of inducing or compensating for a sale is an unfair trade practice.

RULE 2. *Branding.* The marking or branding of products for the purpose and with the effect of misleading or deceiving the purchasers with respect to the quantity, quality, grade or substance of the goods purchased is an unfair trade practice.

RULE 3. *Inducing breach of contract.* The willful interference by any person, firm, corporation or association, by any means or device whatsoever, with any existing contract or order between a seller and a purchaser or sale of any product handled by the industry, or the performance of any contractual duty or service connected therewith, such interference tending to cause a breach of an existing contract or order and being for the purpose or with the effect of dissipating, destroying, or appropriating, in whole or in part, the patronage, property or business of another engaged in such industry is an unfair trade practice.

NOTE: Whenever notice of existence of a contract or order is brought to the attention of any person in any way he shall promptly discontinue all efforts to induce a contracting party to break such contract or order.

RULE 4. *Sale without profit.* The sale of any products relating to the industry without profit for the purpose of injuring a competitor or with the effect of lessening competition is an unfair trade practice.

RULE 5. *Defamation of a competitor.* The defamation of a competitor in any manner, either by inputing to him dishonorable conduct, inability to perform contracts, or questionable credit standing or a false disparagement of the grade or quality of his goods or otherwise, is an unfair trade practice.

RULE 6. *Fraud and misrepresentation.* The making, causing or permitting to be made or published any false, untrue or deceptive statement by way of advertisement or otherwise concerning grade, quality, character, nature, origin, manufacture, or preparation of products is an unfair trade practice.

RULE 7. *Price discrimination.* Any discrimination in price between purchasers (not including discrimination in price on account of the difference in grade, quality or quantity of the product sold), except that which makes only due allowance for difference in cost of selling and transportation, or discrimination in price in the same or different communities and not made in good faith to meet competition, where the effect of such discrimination may be substantially to lessen competition, or tend to create a monopoly, is an unfair trade practice; provided, however, that nothing in this resolution shall be construed to prevent the publication and use of a special quantity price applicable to a definite quantity of goods which are placed in one order and at the option of the shipper are moved as one shipment.

RULE 8. *Threats of suit for patent or trade-mark infringement.* The circulation of threats of suits for infringement of patent or trade-mark among customers of a competitor, not made in good faith but for the purpose of harassing and intimidating his customers, is an unfair trade practice.

RULE 9. *Enticement of employees.* Interference with a competitor's business through the enticement of his employees from his employment is an unfair trade practice.

RULE 10. *Imitation of trade-marks and trade-names.* The imitation of the trade-marks or trade-names of a competitor which results in deception to buyers and consumers, is an invasion of the property rights of such competitor, and is an unfair trade practice.

RULE 11. *Terms of sale.* The industry hereby records its approval of the practice of establishing definite terms of sale and the reasonable adherence thereto, and the continued violation by a manufacturer of his terms, for the purpose and with the effect of price discrimination, is condemned.

RULE 12. *Items contained in cost.* The term "cost" as used in RULE 7, shall be interpreted to include among other items the cost of raw materials, transportation thereof, manufacturing, depreciation, depletion, obsolescence, interest on investment, selling and administrative expense. It is the judgment of this conference that all manufacturers of silos should adopt a uniform cost system.

RULE 13. *Display of photographs.* The display to prospects of pictures or photographs showing a competitor's commodities broken, cracked, blown down, destroyed by fire, or in bad repair, is hereby declared unfair.

RULE 14. *Misrepresentation of technical data.* Misrepresenting the capacity of a silo or cutter; misrepresenting the feeding value of ensilage; mis-quoting feeding tests made by either stations or farmers regarding the merits of silage, is hereby declared unwise and detrimental to the best interests of the industry.

Gonnerman, Turneaure, Woodworth and Lenhardt Honored By American Concrete Institute

At the recent twenty-sixth annual meeting of the American Concrete Institute in New Orleans, H. F. Gonnerman and P. M. Woodworth were awarded the Leonard C. Wason Research medals for work reported in their joint paper on "Tests of Retempered Concrete," presented at the Institute's 1929 convention. F. E. Turneaure was awarded the Henry C. Turner medal for "distinguished service in formulating sound principles of reinforced concrete design." The Leonard C. Wason medal for "the most meritorious paper" of the preceding year's convention was awarded to L. G. Lenhardt for his paper on "The Concrete Lining of Detroit Water Tunnels."

Mr. Gonnerman is manager of the Research Laboratory, Portland Cement Association, and Mr. Woodworth is technical engineer of the Cement Products Bureau, Portland Cement Association. Both have their headquarters in the general office building of the association at Chicago.

F. E. Turneaure has for many years been dean of the College of Mechanics and Engineering, University of Wisconsin, Madison, Wisconsin. In collaboration with E. R. Maurer he is co-author of the textbook "Principles of Reinforced Concrete Construction.."

Mr. Lenhardt is assistant engineer in charge of land tunnels, in the Division of Engineering, Department of Water Supply, City of Detroit.

At the 1930 meeting of the American Concrete Institute Mr. Gonnerman presented a paper, "Study of Methods of Curing Concrete," comprising a report of laboratory investigation of the effectiveness of several of the methods recently advocated for curing concrete roads.

Mr. Woodworth is also the author of two papers which were presented at the 1930 convention, "Some Tests of Concrete Masonry Units Cured with High Pressure Steam," and "Recommended Practice for the Manufacture of Concrete Block and Concrete Building Tile."

Two Manufacturers "Put Over" Manhole Block in a Season

Two of the most aggressive manhole and catch basin block plants in the country are located in Lyndhurst, New Jersey, and Toledo, Ohio.

The Lyndhurst plant, operated by the Multiplex Concrete Company, Inc., has established an enviable record in a comparatively short period of time. Established in the manhole block business late in 1929, the company immediately produced high quality products which met the requirements of the sanitary engineers in the territory being served. Testing laboratory reports indicate that the compressive strength of the block average around 2,000 lb. per sq. in. and that the absorption is usually less than 4 per cent.

"We have erected manholes," states H. W. Bush, vice-president of the company, "in Irvington, Hasbrouck Heights, Montclair, Bogota and East Paterson, New Jersey." According to reports, approximately 100,000 block from the Multiplex plant will be used on a sanitary sewer job involving the construction of about 15 miles of sewer and over 500 manholes, work to begin this spring.

One of 150 concrete block manholes built at River Edge, Bergen County, New Jersey. The Multiplex Concrete Company, Inc., furnished units for this sanitary sewer job

The Toledo plant, operated by the National Cement Products Company, C. B. Fellabaum, president, started to make manhole block early in 1929. Probably its outstanding job is the West Toledo sewer which required manholes 18 ft. deep and 4 ft. in inside diameter. These manholes, which were laid up in 1:3 portland cement mortar, are in very good condition today. They are quite smooth despite the fact that plastering was not required either on the inside or outside walls.

From the Products Associations' Bulletins

Wisconsin Concrete Products Association

JACK FRANKLIN, Secretary-Treasurer

A MARCH issue of the Wisconsin news letter tells members that early in that month the Building Code Committee, composed of three members, of the Wisconsin Concrete Products Association went to the state capital to talk over possible changes in the state building code affecting concrete products and to assure complete cooperation between the commission and the association in the matter of concrete unit tests.

The news letter continues, "The Industrial Commission will issue very shortly an approved list of concrete products manufacturers. This list will be available to architects, contractors, builders and any other person interested in the use of concrete block for industrial construction."

The two requirements of the state regulations are then given, as follows:

"1. The ability to pass the compression and absorption requirements of the State Building Code.

"2. All block must be branded and that brand or trade mark registered with the Industrial Commission."

The following points should be kept in mind so far as securing approval from the Wisconsin Industrial Commission is concerned:

"1. Branding is absolutely necessary and a facsimile of the brand used or to be used must be filed with the Wisconsin Industrial Commission. Bear in mind that even though a physical test meets the requirements, the name of your firm will not appear on the approved list unless your product is branded and the brand registered.

"2. When the State approved list is issued, it will not be final, but it will be impossible for you to get your name on this list if compliance is made after it is issued.

"3. If you have not had a test made within the last six or seven months you should do so at once. Four men outside of the staff of the Wisconsin Industrial Commission and your local building inspector are authorized to select and seal blocks for test."

The last point given is as follows: "According to the ruling of the Industrial Commission, all sizes of block must be tested and recorded before approval is given. If you are making 8 in., 10 in. and 12 in. block, you must have tests of each of these sizes recorded at Madison to secure complete approval from the Industrial Commission."

In Weekly Letter No. 2, dated February 28th, and entitled "State to Have Quality List," report is made of a talk given before the recent annual convention in which a new view on the matter of making tests was given. "O. T. Nelson," the letter states, "discussed the building code requirements from a legal standpoint and brought out the purpose of the building code, which, he said, was to insure strength, provide durability, fire-resistance and suitability.

"Mr. Nelson stated that compliance with the minimum standards is very satisfactory in Wisconsin in so far as the products used in public buildings and places of employment are affected and with which the code is directly concerned. There is, however, a use of much inferior concrete products in structures to which the code requirements do not apply, giving us a double standard of quality. This, from a business standpoint of the manufacturer, will dissipate the good accomplished by the code.

An item in the February issue of the association's monthly "Digest" tells of selling through the eye, and likens the attitude of the prospective concrete products purchaser to that of one considering the purchase of a suit.

"If you can get a buyer to visit your plant, and show him your stock yard of orderly, well appearing piles, he is going to be impressed. Prove quality with your Wisconsin Concrete Products Association Certificate of Quality and you will have a buyer that will take pride in the fact that he buys block from your plant.

"It is a known fact among scientists that in comparing the eye to the ear method of conveying an idea to the brain that the optic nerve is 18 times larger than the nerves of the ear. The eye transmits its impressions to the brain 25 times faster than does the ear. Furthermore, of all the impressions received in the human brain, 87 per cent come through the eye."

Four paragraphs under the title "More Science Needed," states, "When the concrete products manufacturer applies more science to his business and determines the profitableness of merchandise on a scientific basis rather than guesswork, he will discover that price alone is not the determining factor in business, and he will have progressed far toward whipping the new forms of competition.

"With home building in most sections of the United States at a level 26 per cent below that of last year most products manufacturers have the fact staring them in the face that profits for 1929 are smaller than 1928.

"The smart manufacturer, though, is not bemoaning this loss. He has sized up the situation and found that he could increase his business by promotion. A basement takes on an average of 1,000 blocks, but a complete home averages 3,000. So he has gone out and promoted the idea of concrete masonry homes. True, the number he has sold hasn't taken up the slack entirely, but it has gone a long way. And he has found a lot of other uses for his products, too. He's putting them in places he never thought of before."

Iowa Concrete Products Association

R. L. GAVIN, Secretary-Treasurer

THE March issue of "Concrete Products News" concerns largely the program presented at the convention just held.

Non-attending members are scored in a paragraph under "Convention Attendance Important." "You products men," it is stated, "who never attend your conventions are missing a mighty pleasant event. In addition to a program full of valuable suggestions on problems vital to the conduct of your business, there are many other features that make the meeting worth while. The opportunity for informal business discussion with other manufacturers, the renewing acquaintance with equipment and material representatives makes the time spent at the convention enjoyable and profitable."

INFORMATION *and* CONSULTATION

THE HOW-TO-DO-IT DEPARTMENT

These columns are devoted to helping readers solve their problems in all phases of concrete work. Inquiries are invited. Where they can add to or improve upon the suggestions printed, in answer to inquiries from others, readers are also welcome to submit their views for possible publication.

Artificial Stone Aggregate

We would appreciate any information you can furnish on the use of marble and granite aggregates in the manufacture of artificial stone. What we especially desire is a mixture suitable for stone to be used as grave markers.—C. B. A., Cleveland, Mississippi.

In a general way it can be said that artificial stone, or art stone, is most commonly manufactured by crushing marble, granite, or some high-grade limestone, using the coarse crushed material as an ordinary coarse aggregate and the finer material in the place of sand in ordinary concrete. Usually the cement used is white.

An appearance of natural stone is then obtained by mixing some material of a flaky nature such as mica. The names of manufacturers of such materials will be furnished upon request.

The cast stone is then polished the same as ordinary marble or granite, but since the surface is smoother to start with less polishing is required than with natural stone.

Your attention is invited, however, to the possibility of arranging with a manufacturer of cast stone to furnish such material.

Placing of Basement Reinforcing

What amount of reinforcing steel shall be used in basement floors where, in the summer, irrigation water comes up to within three feet of the top of the ground? I realize waterproofing would be one means but there are many places where we cannot pour more than 4 inches of new concrete over the old because of headroom under the joists.

With 62½ lbs. pressure to the square foot from below and with the water rising 1 ft. deep in the cellar, what size steel should be used and how should it be spaced?—C. C., Toppenish, Wash.

In constructing a concrete floor having 2 ft. of water pressure from below, it will be necessary to design the floor as if it were a floor slab. The live load then for 2 ft. of water pressure would be 125 lbs. per sq. ft. From this you will subtract the weight of the floor, say, approximately 75 lbs. per sq. ft., for which you must provide.

The amount of reinforcement necessary depends, of course, a great deal upon the spans involved. The distance between the posts and the columns and the walls and partitions all enter in if a very accurate design is desired. In this particular case, however, it will not be necessary to go into detail to this extent.

With a live-load pressure under the floor of 75 lbs. per sq. ft., reinforcement totaling approximately ½ sq. in. for each square foot of cross sectional area will be sufficient. This amount of reinforcement can be secured by using either a heavy wire mesh or by placing ½ in. bars on 6 in. centers.

Inasmuch as the pressure is from the bottom of the slab, the reinforcement should be placed near the top of the basement floor so as to get it in the tension area of the section.

Casting Thin Concrete Slabs

We are considering the erection of a cell block at the Michigan Reformatory, using thin precast concrete slabs to form the rear and sides of cells. How should they be cast and reinforced?—W. J. R., Lansing, Michigan.

The quality of the concrete used in such slabs should be fully equal to that in the best reinforced concrete work. The precast slabs should be cast in a horizontal position, and in addition to the regular steel reinforcement intended for service after the slabs are in place, special reinforcement and special devices will be needed for lifting and handling the slabs after they are hardened.

It is best to place the main reinforcement near the middle, in two directions, carefully wiring the reinforcement of one layer to the bars in the other layer. Or, if possible, better work may be obtained by welding the bars together at intersections, thereby making a sort of grill.

Handling devices should be set in place before the concrete is deposited, so that the gripping or anchoring part of the device will become thoroughly imbedded in the fresh concrete. Once the slabs are in final place the handling rings are unscrewed from the imbedded anchor and the holes are filled with mortar.

One or two extra bars must be placed alongside the handling devices, and in each direction, so as to distribute the load when the slabs are lifted. It is best to have two handling rings attached to each slab, to distribute the load to better advantage.

The form lumber for the slabs should be of dressed material, tongue-and-grooved, in order to provide a smooth and true surface on the finished slabs.

Your inquiry does not indicate whether the slabs are to be thin, for use in locations where there will be no attempt to cut through them, or whether they are to be of considerable thickness and heavily reinforced and capable of resisting efforts to cut through them. In the latter case it is customary to use special reinforcement prepared and furnished to correct sizes and dimensions by companies that specialize in such work. Names of such companies will be furnished upon request.

Concrete for the Builder

A Department Devoted to the Promotion and
Practical Construction Details of Concrete Work

Success—How to Attain It

J. J. Klein Builds Up Highly Successful Concrete Contracting Business Centered in Dallas, Texas—Integrity of the Firm, the "Fifth Ingredient," Largely Responsible

By T. A. DAY

An important "ingredient" of any product is the integrity of its producer, and the careful buyer always looks for this quality.

J. J. Klein, president of the Klein Brothers Company, Dallas, Texas, says with characteristic aptitude, "It is commonly known that concrete is made with cement, sand, gravel and water. Anybody can take these four ingredients and make up a mixture. The proper blending of these products determines how well the mass will withstand the force of impact. It is possible to mix the concrete so that it looks good when first placed, but without the wearing qualities. It undoubtedly is true that the buyer of concrete work has no way of knowing when he is getting a good product, any more than the average individual can be the judge of fabrics, precious stones, or art work."

The "Fifth Ingredient"

Because it is difficult for the average individual to judge concrete work, Mr. Klein has founded his business on what he calls the "fifth ingredient," his own integrity. Buyers of concrete from the Klein Brothers Company know without looking for it that they are receiving this important "ingredient."

Inasmuch as integrity is the very foundation of its business, the Klein Brothers Company published an attractive booklet, "The Fifth Ingredient," describing the activities of the firm and the success it has enjoyed through serving its customers well. Although this booklet was issued in 1925 on the occasion of the passing of the one hundredth anniversary of the use of concrete and the thirty-sixth year of J. J. Klein in construction work, it carries an important message today to concrete contractors and their customers.

"In the little town of Macon, Missouri, thirty-one years ago," according to "The Fifth Ingredient," "a workman, clad in overalls, arose from his knees and surveyed with prideful satisfaction what he knew to be work well done.

"The 'new kind' of sidewalk in front of the principal shoe store of the town had just been completed," the story continues. "The materials used had been the subject of

Concrete fountain basin built in 1916 by Klein Brothers Co.

much comment. Old-timers in the village wagged their heads in disapproval, and seemingly found delight in their prediction that this material just naturally wouldn't stand up. 'You can't beat flagstone or good brick for a sidewalk,' they opined. Others remarked that they had seen this kind of material in the big city down on the Mississippi, and 'twas all cracked clear through.

"The idlers had stood by and watched the various stages of the work as it progressed. They had seen the sand, the gravel, the cement, piled high in the street and had seen it mixed with water. None, however, had seen the 'fifth ingredient'—that something without which no work can long endure. The workman alone knew it was there. He had 'poured' it, full measure, into the mixture."

This concrete sidewalk on Vine Street, Macon, Mo., has stood the test of time. It was laid in 1893 by J. J. Klein. Note the perfect condition of the surface after 30 years of service

Two Letters Tell Story of Performance

The workman, clad in overalls, was J. J. Klein; and in 1898 he recevied a letter from H. C. Gieselmann, the owner of the store in front of which the walk had been built. And in 1924 he received another letter from the same man. Both letters are quoted here, for they tell a story of performance, a story of what the "fifth ingredient" means in concrete work.

The first of Mr. Gieselmann's letters read as follows: "Having known J. J. Klein for a number of years, I can recommend him as an honest, upright man and as an extra first-class workman in his line. I have had work done by him and am more than pleased with it. My walk in front of my store has been down now very near four years and it is yet in first class shape without a crack. He has done work all over our city of Macon and it is giving the best of satisfaction. Anyone wanting work done in Mr. Klein's line cannot miss it by giving him the work."

And after twenty-six years Mr. Gieselmann again wrote to Mr. Klein, addressing the following letter to whom it may concern:

"Twenty-six years ago, I wrote J. J. Klein a letter, recommending a walk that at that time had been down four years. I want to say for him that not only my walk, but also the walks around two business blocks here that he put down at the same time stand today as good as when they were put down. I doubt that you can find more than half a dozen small checks in the two blocks. It is not necessary for me to say more for him, as his work shows that fair dealing has won for him the success he so justly deserves. It is a pleasure to recommend J. J. Klein to anyone desiring his services."

What more can be said of a concrete builder? The "fifth ingredient" is, indeed, an important "component" of any concrete mixture.

A Long and Honorable Career

It is now thirty-six years since J. J. Klein himself placed the first concrete sidewalk in Macon, Missouri, and the forty-first since he first took a trowel in hand to pave smooth, enduring pathways for countless millions. The booklet, "The Fifth Ingredient," again sums up his accomplishments. "Dollar for dollar, and something that dollars cannot buy—full value, not only as represented in the quality and proportion of materials used, but also as represented in conscientious endeavor to combine with the best materials the consummate skill at his command—has ever been the policy of J. J. Klein from the earliest days of his experience. Integrity—the 'fifth ingredient'—has gone into every concrete project with which Mr. Klein has been identified, and upon this enduring ethical foundation he has built an organization which has been a notable contributory factor of civic beauty and permanent service throughout the South and the Southwest."

Family of Concrete Men

Mr. Klein is one of a family of so-called concrete men. "I remember well the very day I started to work," he states, "and especially how fortunate I felt in having made a connection with P. M. Bruner, an eminently successful contractor in St. Louis at that time. I further counted myself especially fortunate in that my training would come under the direction of four uncles who had established an enviable reputation as concrete men, and who were also associated with Mr. Bruner. In the vernacular of today, I was 'in right.' I recall, too, my eagerness to begin work at once rather than wait for Monday of the following week. And so, on Friday, August 21, 1889, the training for what has since been my life's work began, laying a foundation for thoroughness which has ever been an asset of inestimable value, and a source of satisfaction to all whom I have served."

Rollin Street, Macon, Mo., is another example of what Mr. Klein terms "life-time" service. This walk was built in 1894 and photographed in June, 1924

In 1892, Mr. Klein became associated with the American Granitoid Company. He remained with this company until the next year, when he and two of his uncles established a concrete contracting business in northern Missouri, operating under the name of Klein Brothers. The uncles later returned to St. Louis, while Mr. Klein continued the contracting business in Macon, Missouri, and Iola, Kansas, under the name of J. J. Klein. At the end of 1904 he had served thirty cities and towns, providing them with sidewalks that today are in excellent condition.

Established in Dallas in 1904

J. J. Klein, President of Klein Brothers Company

Mr. Klein transferred his business to Dallas, Texas, late in 1904. With reference to moving to Texas, he says, "I left behind me millions of square feet of good sidewalk, every inch of which had been built upon the principle of full value—each sidewalk, in its excellent state of preservation, bearing witness to honest endeavor, painstaking skill and the 'fifth ingredient'—integrity."

Mr. Klein's brother, A. J. Klein, became associated with the Dallas firm in 1904, the two men operating under the name of Klein Brothers. They contributed conspicuously to the development of Dallas proper and its residential additions, and grew with it themselves, until the Klein Brothers Company of today is one of the largest and most favorably known in the South and Southwest. Their records show that in Dallas, alone, the Brothers Klein have built more than 2,000,000 feet of concrete curb and gutter, besides many millions of feet of walks and driveways laid in the principal residential additions. The firm regularly employs 200 to 300 men, and from 15 to 18 crews are kept busy at all times.

Foremen Grew Up with Company

"All of our foremen and workmen are men who have received their training with us . . ." says Mr. Klein. "This feature of our organization is especially noteworthy, in that every foreman is qualified to render a service typical of our standard." Some of these men worked side by side with Mr. Klein in the early days before he established his business in Dallas.

A reinforced concrete stairway constructed by J. J. Klein and associates in 1924

When "The Fifth Ingredient" was published, Oscar Galm had worked for the Klein Brothers Company for 29 years; John Meyers, 27 years; Ben Klein, 25 years, Louis Heigele, 24 years; J. H. Gentry, 23 years; John Meadows, 22 years; George Klein, 20 years; J. R. Long, 20 years; B. F. Klein, 19 years; Fred Stanfield, 18 years; William Meyers, 17 years; W. D. Guinn, 17 years, Joe O'Riley, 16 years; J. S. Sticksel, 16 years; S. M. Meadows, 15 years; John Ferguson, 15 years; Pauline McMillan, 10 years; and W. B. McElroy, D. H. Shelby, J. L. Phillips, 5 years, and B. W. Jaeger, now secretary of the Klein Brothers Co., 3 years. Most of the others are also associated with the company today.

Some Old-Fashioned Thoroughness

The foremen and workmen employed by the Brothers Klein have made good under the most exacting demands of the company. The foremen are not only skilled individually but they are fit to supervise every job and see that every man under their direction shall perform his appointed work in accord with the company's standard. Veterans of the craft of concrete construction, these foremen select only the most expert workmen. The zeal of all foremen is such that they do not hesitate to work personally themselves, if necessary, to bring a job to its full perfection. To the extreme care of these men is due the enduring service for which Klein concrete work is noted.

An attractive booklet that pulls business

There appears to be much old-fashioned thoroughness and individual attention in the Klein Brothers Company; thoroughness and attention of the kind that attended the laying of the first concrete sidewalk in the little town of Macon, Missouri, and the four city blocks, paved on both sides of the street, which were later laid by the original workman, now president of the company.

Great Variety of Work in Concrete

Accompanying illustrations show sidewalks built by J. J. Klein in 1893 and 1894. The principle which has made these sidewalks as good today as they were when laid obtains in the sidewalk construction the company does today. The company's present-day business is not limited to sidewalk building, but also includes construction of curbing, gutters, steps, small bridges, swimming pools, lily pools, fountains, tennis courts, stairways, porch, residence and basement floors, driveways, foundations, small dams, retaining walls, septic tanks, mausoleums and some street, roadway and alley pavements, sewer and waterworks systems.

Special Attention to Floor Topping

Because of the general interest in concrete floors, especially for residences, the definite guarantee of the Klein Brothers Company regarding topping for such floors is an interesting sidelight. The booklet, "The Fifth Ingredient," includes the following statement with reference to "Floor Topping that Adheres Permanently":

"In order not to crack off under hard usage, the topping must become as much a part of the floor as if the whole mass were laid at the same time. In other words, the topping should not be an extra layer or slab 'put on,' but an inseparable part of the concrete unit.

"Floor topping, then, calls for a broad knowledge of materials and most skillful handling in laying as well as in preparing the mixture.

"The Klein Brothers Company has made floor topping a specialty and with unparalleled success. . . . In the Shippers' Compress and Warehouse Building, Dallas, more than 600,000 square feet of floor topping were laid. Floors for hospitals essentially call for a very smooth, sanitary surface, while those of the industrial building must be constructed to stand severe and constant service.

"Whatever the nature of the building, floor topping put in by the Klein Brothers Company is made to conform, thus insuring the utmost service and nicety of appearance."

The foregoing statement is quite evidently a guarantee of the integrity of the company, it is part of the "fifth ingredient" and is worth the earnest consideration of every concrete builder.

There are other examples of the concrete work done by the Klein Brothers Company. In the Dallas plant of the Ford Motor Company, for example, there are 300,000 square feet of concrete floor built for hard service.

Operate Over Large Territory

Although the Klein Brothers Company is a Dallas, Texas, concern, it serves municipalities, construction companies, engineers, architects and builders throughout the entire Southwest. The following towns and cities are included in the list of municipalities in which work has been done:

Texas—Abbott, Dallas, Arlington, Carrollton, Cleburne, Decatur, Ennis, Farmersville, Ferris, Forney, Fort Worth, Greenville, Hico, Highland Park, Hillsboro, Honey Grove, Houston, Irving, Itasca, Ladonia, Lancaster, Liberty, Loving, McKinney, Mexia, Mequite, Midlothian, Mount Vernon, Palestine, Paris, San Antonio, Stephenville, Terrell, University Park, Vickery, Waco, Waxahachie and Wolfe City.

Missouri — Macon, Chillicothe, Clarence, Columbia, Kirksville, La Platte, Louisiana, Mexico, Montgomery, Paris, Rich Hill, Springfield, St. Louis, Unionville and Vandalia.

Kansas—Iola, Arkansas City, Baldwin, Bassett, Cheney, Cherryvale, Coffeyville, Gas City, Garden City, La Harp, Oswego and Winfield.

Others—Bartlesville, Oklahoma, Memphis, Tennessee and New Orleans, La.

The Klein Brothers Company maintains an office in Dallas with a staff of employees that keeps the wheels of business in operation. There is also a sales force of four men that merchandises the services of the company. Probably one of the principal sales arguments used by these men is the fact that the company is a strong believer in the "fifth ingredient."

Klein Brothers spend about $1,000 each year for advertising. The files of the company reveal many interesting testimonials—from mayors of cities, engineers, builders, bankers, architects, realtors, executives and others—attesting to the integrity of the organization and its excellent concrete work.

This story of J. J. Klein, who chose concrete contracting as his life's work, is an account of real success and how to obtain it. The achievements of Mr. Klein and his associates may be a bit above the average, but certainly such accomplishments are within the reach of all who have the will to grasp them.

Efficient Small Town Garage and Service Station

The accompanying photograph shows the efficient layout of a garage and service station that is specially adaptable for small cities, this garage being located at Modesto, California. It was specially designed and built for the convenience and comfort of motorists by William Silva after he had visited a large number of cities looking for ideas. Just how concrete features have added to the efficiency of the garage is shown.

A wide, double driveway through the main floor is of special red concrete, and permits driving in and out without the usual backing up or turning around, one driveway being used as the entrance and the other exclusively as an exit.

The large gasoline tanks are so located that the gasoline pump is mounted on a ten-inch raised concrete base in the center of the curve of the concrete driveway in the rear permitting cars to be filled with gasoline without blocking the driveway.

Anchoring Machinery to Concrete

Strong anchorage for the attachment of machinery to concrete foundations is secured by imbedding the anchor bolts in the concrete before it has hardened, correctly spacing them with the aid of a template. For ease in adjustment a pipe sleeve larger than the bolt can be slipped over it and filled with cement mortar after the machine is lined up and before it is finally bolted down. After the concrete has hardened sufficiently to grip the bolts the template can be taken off and the surface leveled.

Water for Concrete

Water used to mix concrete should be clean, free from oil, alkali and acid. In general, water that is fit to drink is best.

Fires—and the Concrete Builder

What Do Residence Fires Mean to You?—They Can Mean New Business if Accounts of Them Are Properly Incorporated in Sales Arguments for Concrete Floors

TWO PERISH IN BURNING HOMES; SIX ARE RESCUED, is the message delivered by the morning paper to the busy business man traveling to his daily work.

FIRE DRIVES 150 INTO SUBZERO WEATHER is the message delivered by the evening paper to the busy business man returning home from his daily work.

According to the story in the morning newspaper, "both fires were believed to have been caused by overheated furnaces." The evening newspaper relates that the fire "started in the basement" and "spread so rapidly that virtually none of the occupants had sufficient time to don heavy clothing."

Residence Floors of Concrete

It is almost needless to say that neither of these places of residence was protected against the dangers of basement fires,—that is, safeguarded against such menacing dangers by means of a concrete first floor. The business man whose home has such protection merely passes over fire items in the daily press. On the other hand, the man who insists on full fire safety in the hotels he uses while traveling, in the school building where his children spend hours in the pursuit of education, and in the office building where he himself spends the greater part of each working day, may have overlooked a far more important item—his home. There are many such men. They insist on having complete fire protection in hotels, schools and office buildings, but fail to realize that it is just as essential in their own home.

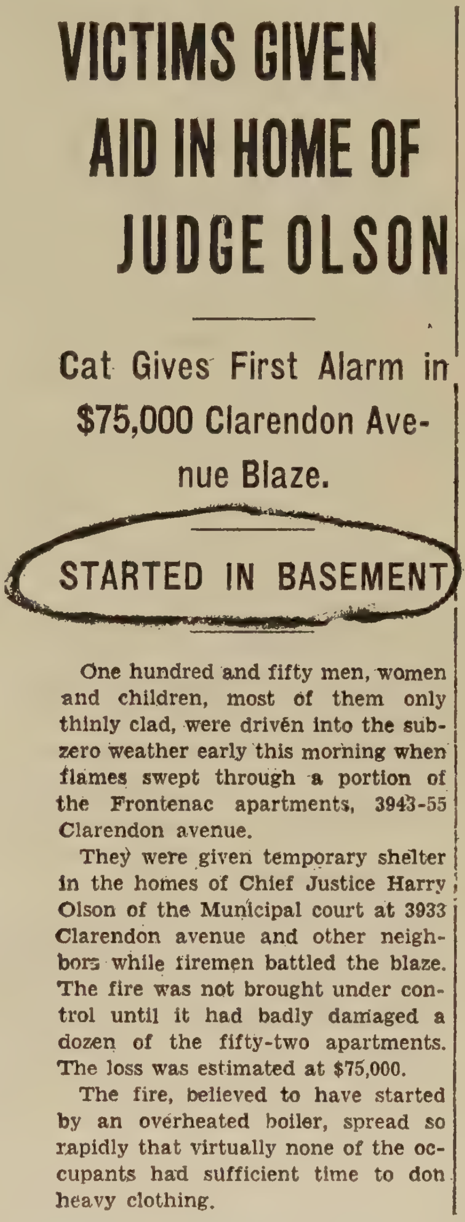
Appeals to Business Men

It is this group of men with whom the builder can work to increase his market for concrete residence floors. Such fire items as are reproduced here appear in other newspapers throughout the country almost daily. Live-wire concrete builders are using these fire items as sales aids. Some make scrap books of clippings; small books that can be carried easily and referred to handily by a salesman. The sales talk would be something like this:

"Mr. Wilson, I understand that you are planning to build a new home next spring. Tell me, what kind of a first floor have you specified?"

The answer, nine times out of ten, will be: "Why, just the ordinary kind that is usually put in a modest home of the kind I plan to build."

"Do you mean to say you aren't specifying a firesafe floor? What I mean is a concrete floor—the kind that is used in this office building, a floor that is firesafe, one that is required in the city schools, one that is used almost exclusively in the fireproof hotels. Last year 2,000 such floors were built in residences, houses of the type you plan to build."



VICTIMS GIVEN AID IN HOME OF JUDGE OLSON

Cat Gives First Alarm in $75,000 Clarendon Avenue Blaze.

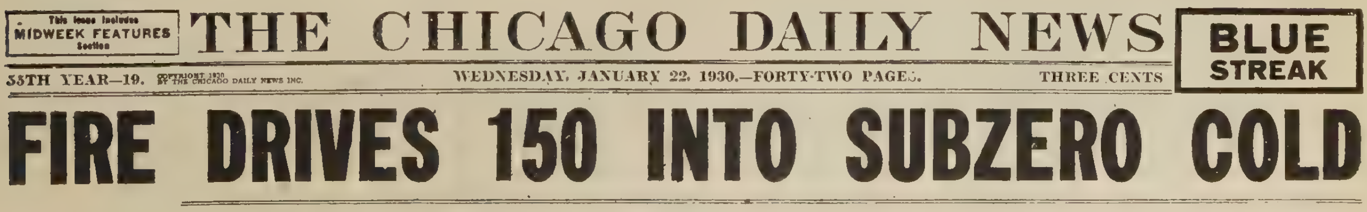
STARTED IN BASEMENT

One hundred and fifty men, women and children, most of them only thinly clad, were driven into the subzero weather early this morning when flames swept through a portion of the Frontenac apartments, 3943-55 Clarendon avenue.

They were given temporary shelter in the homes of Chief Justice Harry Olson of the Municipal court at 3933 Clarendon avenue and other neighbors while firemen battled the blaze. The fire was not brought under control until it had badly damaged a dozen of the fifty-two apartments. The loss was estimated at $75,000.

The fire, believed to have started by an overheated boiler, spread so rapidly that virtually none of the occupants had sufficient time to don heavy clothing.

Clipping from The Chicago Daily News telling of another fire whose severity could have been lessened by fireproof construction



This issue includes MIDWEEK FEATURES Section

THE CHICAGO DAILY NEWS

BLUE STREAK

55TH YEAR—19. COPYRIGHT 1930 BY THE CHICAGO DAILY NEWS INC. WEDNESDAY, JANUARY 22, 1930.—FORTY-TWO PAGES. THREE CENTS

FIRE DRIVES 150 INTO SUBZERO COLD

It is difficult to continue this sales talk because each prospect encountered by a concrete floor salesman requires special handling. A man may appreciate the firesafeness of a concrete floor and want such a floor in his new house . . . he may consider the cost excessive . . . and there are other so-called objections. The concrete builder or his representative who is well versed in the reasons why concrete floors for residences are worthwhile can overcome any and all such objections.

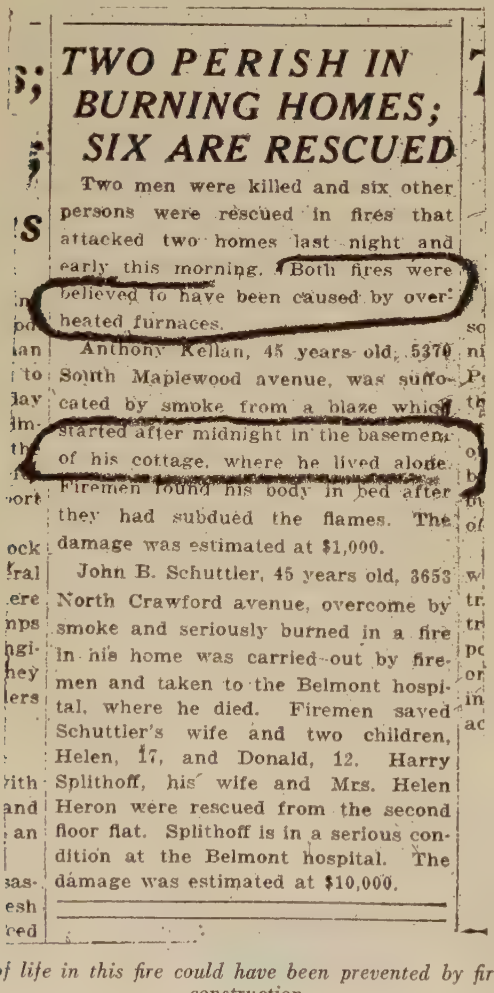
The Key to Firesafe Homes and Concrete Floors for Residences

The former includes many sales arguments for concrete floors; the latter not only tells how to build them, but gives additional information that is helpful in selling.

Cashing In on Fires

Fires can mean new business for the concrete builder. Those progressive contractors who have come to realize that selling the concrete residence floor market is one of the best ways to expand their business are "cashing in" on fires and doing their customers a distinct service at the same time. They are selling concrete floors to the fire victims, those who have lived through fires and who are using their insurance money to build new homes. They are selling concrete floors to those who may be fire victims in the future, those whose homes are planned to have combustible floors.

Concrete floors have countless other advantages aside from firesafety, but their fire-resistive quality is an important selling point. Many concrete builders are now reading more closely the fire articles in newspapers to learn where each fire started. If it started in the basement and the house did not have a concrete first floor, the damage from fire usually is great. If it had a concrete first floor, the damage usually is practically nil. Both types of stories can be placed in the salesman's scrap book.



TWO PERISH IN BURNING HOMES; SIX ARE RESCUED

Two men were killed and six other persons were rescued in fires that attacked two homes last night and early this morning. Both fires were believed to have been caused by overheated furnaces.

Anthony Kellan, 45 years old, 5370 South Maplewood avenue, was suffocated by smoke from a blaze which started after midnight in the basement of his cottage, where he lived alone. Firemen found his body in bed after they had subdued the flames. The damage was estimated at $1,000.

John B. Schuttler, 45 years old, 3653 North Crawford avenue, overcome by smoke and seriously burned in a fire in his home was carried out by firemen and taken to the Belmont hospital, where he died. Firemen saved Schuttler's wife and two children, Helen, 17, and Donald, 12. Harry Splithoff, his wife and Mrs. Helen Heron were rescued from the second floor flat. Splithoff is in a serious condition at the Belmont hospital. The damage was estimated at $10,000.

Loss of life in this fire could have been prevented by fireproof construction

Start your scrap book today; if necessary, go to your local newspaper office and get back copies of papers published during the "fire season" in the fall of the year when furnaces are started. You will find this scrap book to be an excellent sales aid. The book plus aggressive salesmanship will mean increased concrete business and increased profits.

Finance Holding Body Organized to Give Modernization Credit

To simplify and systematize the financing of home betterment the National Building Survey Conference has announced plans for the organization of a central finance holding corporation to make available to householders credit for repairs and improvements of all kinds.

Fenton B. Turck, of New York, chairman of the conference, organized to carry forward the business stabilization movement, in making the announcement explained that the proposed holding company would tie together the activities of a number of finance corporations now operating in this field. It would, he said, enable the home owner to undertake all sorts of repairs without the confusion of dealing with a number of separate agencies.

"Such a holding company," said Mr. Turck, "would in no way represent a merging of present agencies. It merely would co-ordinate their operations in such a way as to give the greatest benefit to the owner of a home who desires to modernize his property, but who has not enough ready cash on hand to go ahead with his plans. There has long been felt the need of such a central organization. At present the owner has to deal with so many separate agencies that the handicap tends to deter him from going ahead.

"Throughout this present movement to encourage needed building operations as a means of reducing unemployment and of stimulating general business it has been emphasized that the field of home improvement offers a major opportunity for obtaining immediate results. Surveys have revealed that as many as two million homes are in need of repairs and improvements."

"High Cost" of Concrete Floors Proves to Be Myth

Harold S. M. Mahan, a St. Joseph, Mo., contractor, recently built his first concrete residence floor. When the job was done, he figured the construction cost at 44 cents per square foot. He is confident that in subsequent jobs he can reduce the cost to even a lower figure.

Average costs of concrete floors in St. Louis, Kansas City and other large cities indicate that such floors should cost not more than 50 or 55 cents per square foot. Many experienced contractors are getting the work done at a unit cost of 45 cents.

The first cost of concrete floors is admittedly more than combustible construction, but the differential is usually less than commonly estimated by architects and builders who have had no experience with this type of floor construction. Also, the differential is very substantially decreased by a few years of reduced interior maintenance and redecorating charges.

Swimming Pools

An Opportunity in Your Neighborhood

Here Is a Suggestion for Another Good Job—But It Must Be Sold—The Sales Arguments Are Given in This Article—Use Them in Your Community—Detailed Construction

THERE are numerous community activities which are usually adequately provided for, such features as playgrounds, recreation fields, and golf courses usually being well taken care of. The advantages and desirability of having a swimming pool cannot be overlooked in a well-balanced healthy community.

In urban and suburban districts the "Old Swimming Hole" is but a memory of the past. Yet, swimming is one of the most healthful recreations, and may be enjoyed by both young and old. The tendency of the age is to pursue some athletic hobby which promotes physical development, zest of living, a desire to succeed and instills a spirit of sportsmanship.

Our public recreation facilities, bathing beaches, etc., are never adequate to care for the needs of an ever-growing population. Participation in this form of sport is always hampered by the lack of natural bodies of water.

It is not the intention of this article to treat the various aspects of swimming pools but to briefly point out the dividends in health that may be expected from a comparatively small investment and some of the methods of financing their construction.

A study of the illustrations will reveal the wide range of design and the details of construction and suggest structures that may be simple and of comparatively moderate cost.

The requirements for a swimming pool will be of a different character in urban than in suburban communities. In the former the high land values require that less property be used for this purpose than is allowed in suburban communities.

How to Finance a Swimming Pool

The financing of a concrete swimming pool in the average community is not a difficult matter. Public funds are sometimes available for this purpose. Special bonds may be issued. In the absence of a budget to cover the cost of such construction, other methods may be utilized.

Funds may be obtained by public contributions. If donations of labor, equipment, building materials and professional services are accepted as well as cash, it enables everyone to assist in the campaign and minimizes the task on the part of all.

The co-operation of Rotary, Kiwanis and Lions clubs and the American Legion posts can usually be secured for such purposes. Civic organizations may also render valuable assistance.

Widest publicity may be secured at little or no cost for campaigns of public welfare.

When sufficient public interest is created a considerable portion of the construction cost of the pool may be derived from the sale of season tickets or life memberships which allow holders to use the pool at any time without additional charge.

Many pools have been built as commercial enterprises by business men. When favorably located and intelligently operated such pools are a very profitable investment.

Selecting the Site

In selecting the site for an outdoor pool, a location should be selected where natural drainage may be had, where real estate values and physical restrictions do not render the cost of construction prohibitive and so located that the maximum number of people may reach it with a minimum expenditure of time and effort. It is extremely desirable to have a source of water supply close at hand, as this will reduce the cost of laying mains for pool water supply.

In order that the pool may be cleaned and flushed it should be located conveniently close to storm drains or sewers. The foundation soil should preferably be porous, effecting natural drainage; if not, an adequate drainage system should be provided under the floors and footings so as to prevent damage by frost. Location is vital to the success of a commercial pool.

Inasmuch as every pool presents an engineering problem the employment of a competent architect or engineer cannot be too greatly emphasized. The computation of strength will not be discussed. The construction of the pool must be absolutely watertight and sufficient to resist the loads, which are considerable. Adequate jointing details must be considered as of great importance. They must be protected against percolation from the outside as well as the inside.

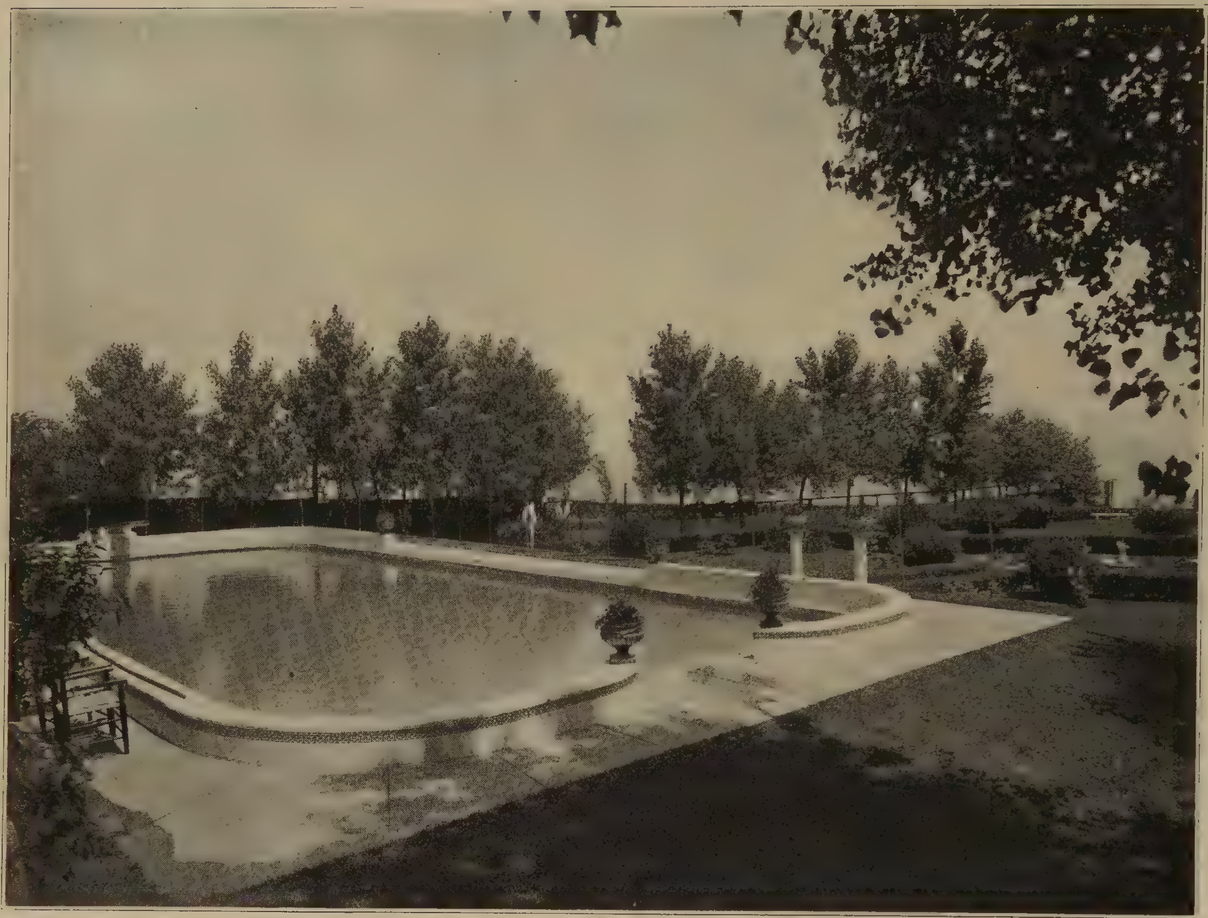
Water Supply

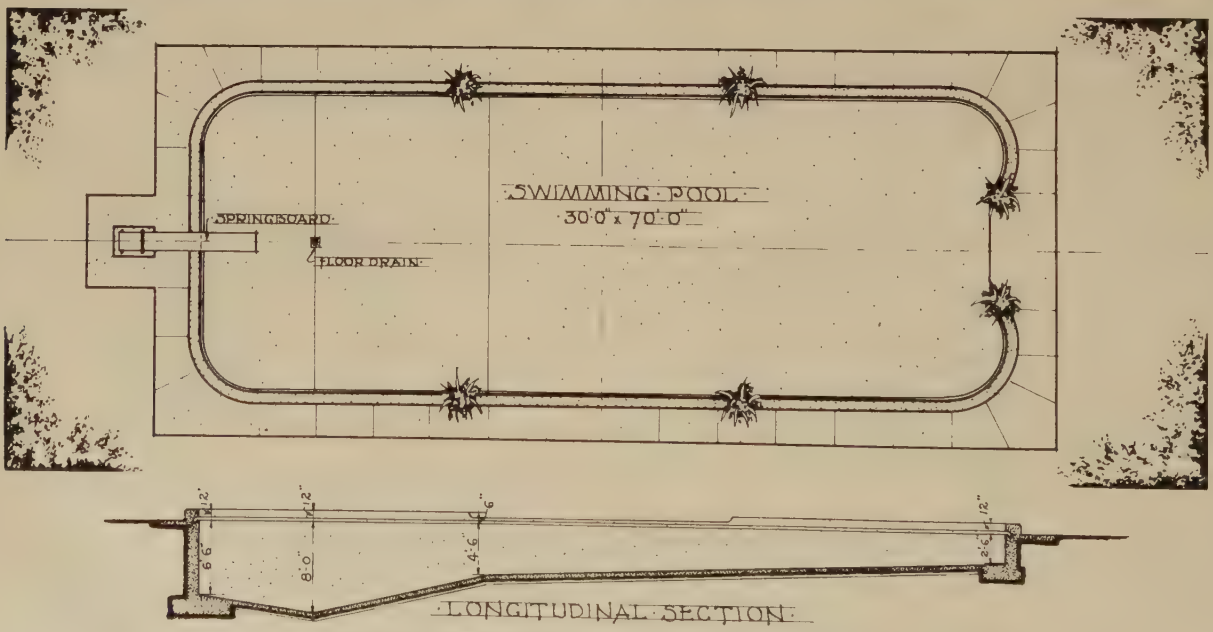
Usually no provision is necessary to heat the water in outdoor pools, an exposure to the sun and wind for a few hours after filling is sufficient to attain a favorable temperature. Where heating is resorted to, a closed type heater with copper or brass coils thermostatically controlled is probably the most desirable type. A cheap and quick method is the injection of steam. The last method is by far the most economical, although it is sometimes accompanied by the deposit of oil, rust or scale from the boiler.

The supply line should be of sufficient size to fill the pool within 24 hours. The water should be clean and sterile. Occasional bacterial tests should be made to determine its pollution. Filtration, chemical and mechanical processes, may be used as additional health insurance.

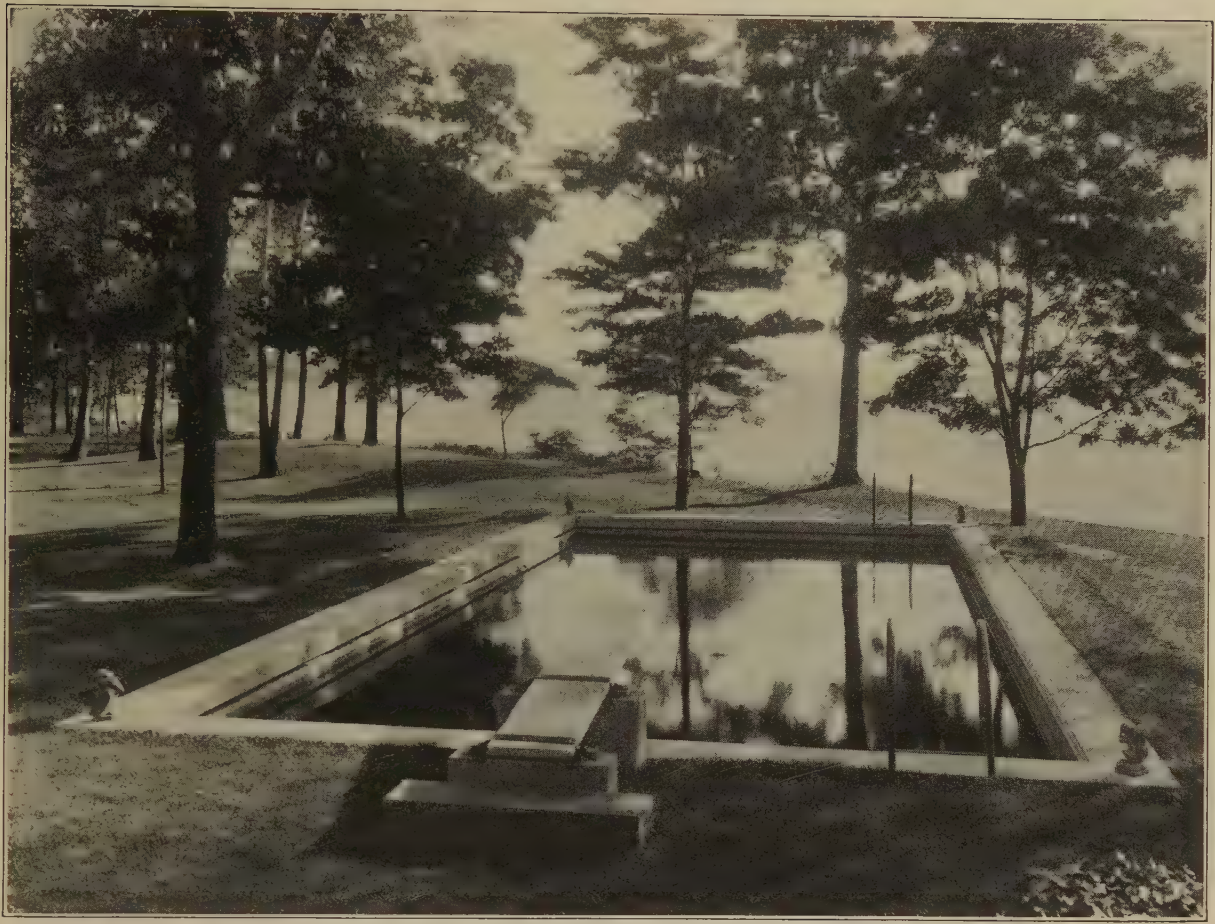
The minimum dimensions of a swimming pool, as prescribed by the Intercollegiate Rules for Athletic Contests are: Width 20 ft., length 60 ft. Pools should measure in multiples of 5 ft. in width and 15 ft. in length.

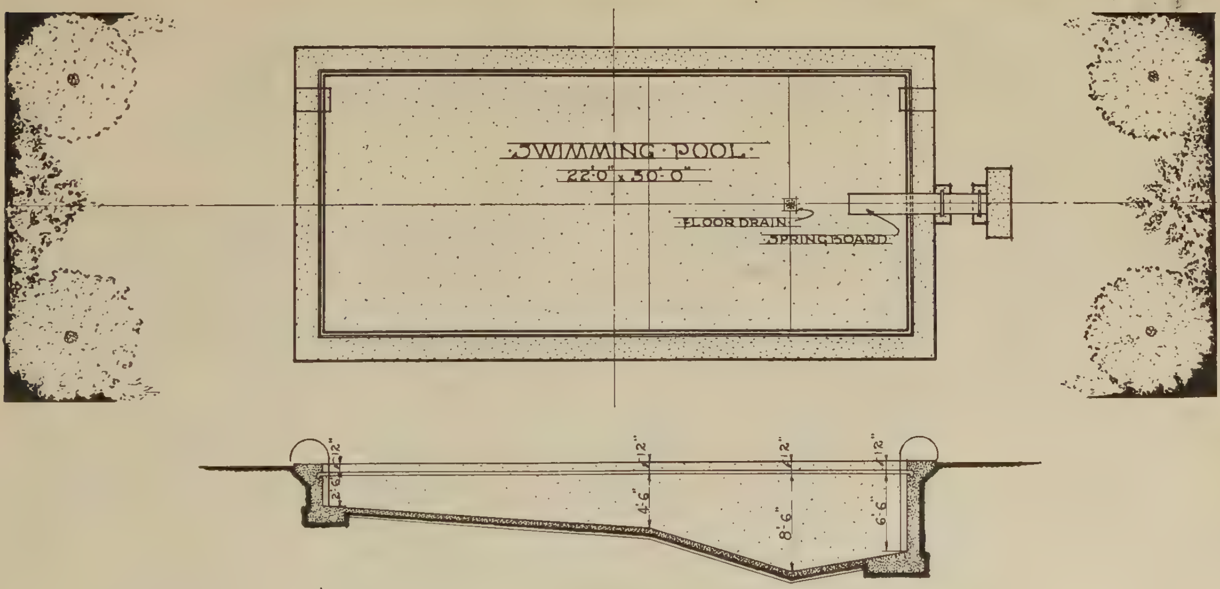
20 x 60 ft.	20 x 75 ft.
25 x 60 ft.	25 x 75 ft.
30 x 60 ft.	30 x 75 ft.





· CONCRETE · SWIMMING · POOL ·





·LONGITUDINAL·SECTION·

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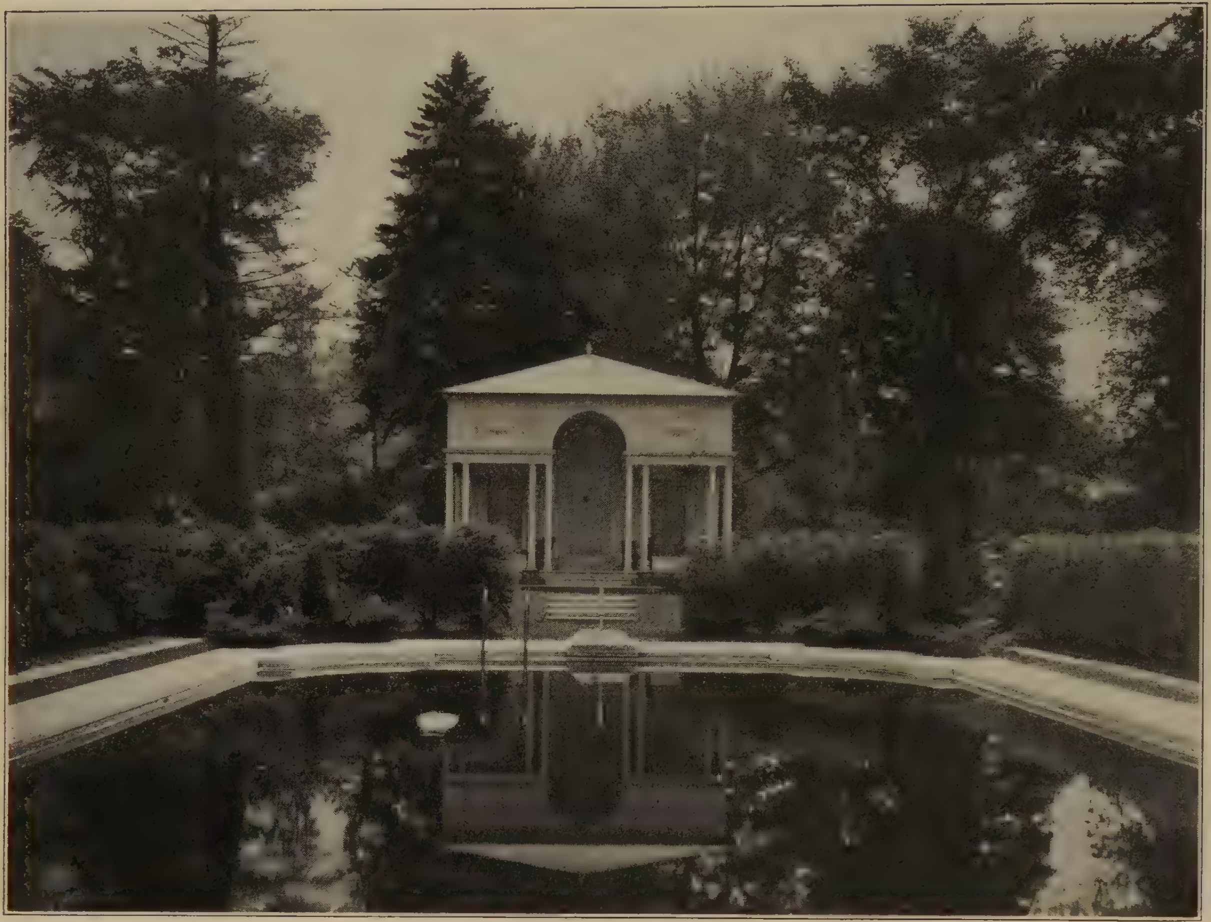
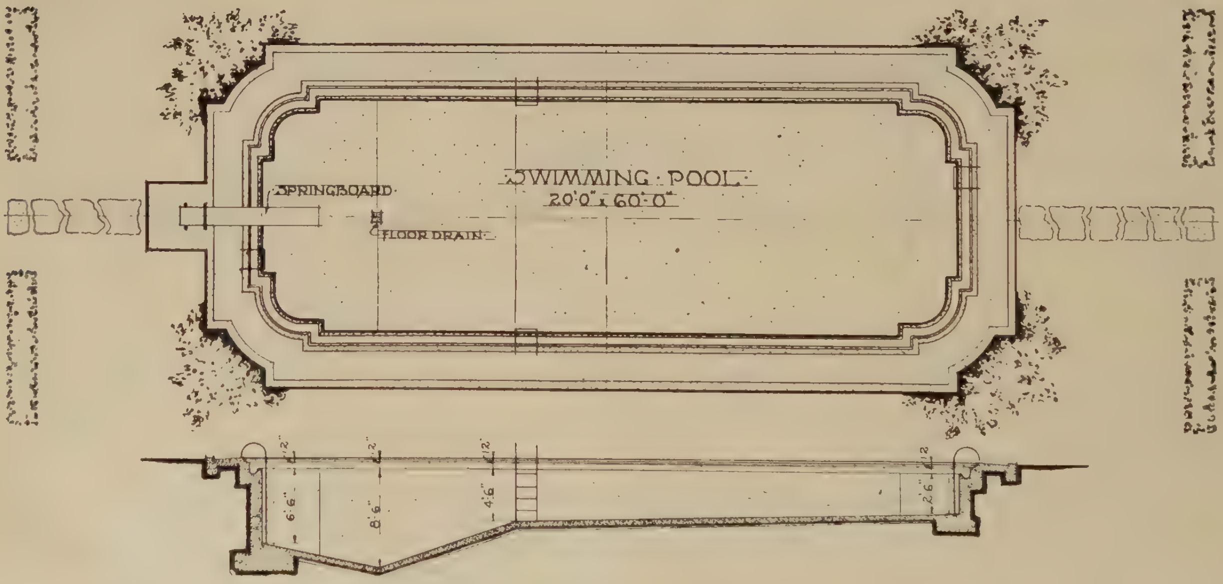
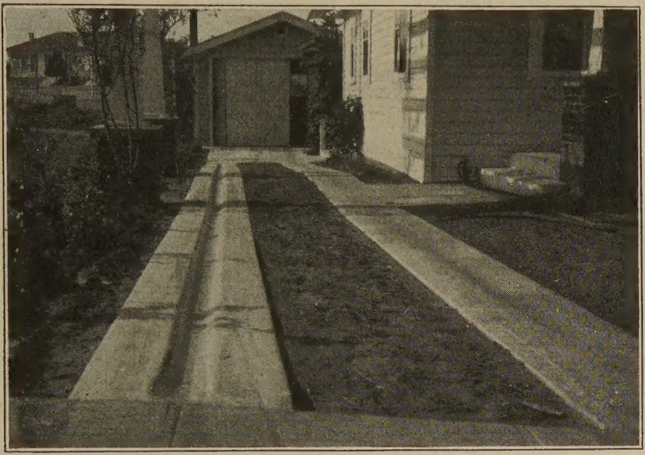




CONCRETE · SWIMMING · POOL ·

A Solution of the Garage Driveway Problem

A resident of Brea, California, has found a simple, effective, and inexpensive solution of the garage driveway problem which should be of interest to contractors who do miscellaneous concrete work. In the construction of his driveway leading from the street to his garage, situated at the rear of his lot, his contractor molded a rut or runway in the center of the left-hand ribbon of concrete for use as a guide in driving in or backing out of the garage. On entering, the left front wheel is placed in the groove; and, on emerging, first the left rear and then the left front wheel are centered in it. Thenceforth, no further manipulation of the steering wheel is necessary while traversing the length of the drive.



The groove is placed on the left side, directly under the driver's seat, so as to enable him to aim straight when entering it. The rut is three inches deep, its width being determined by the diameter of the tires. It is advisable to arrange for the surface of the left-hand ribbon to be about two inches higher than that of the right-hand ribbon, so that the bottom of the groove will be about one inch lower than the flat-surfaced ribbon on the right. This gives the automobile a slight tilt to the left, which causes the two left wheels to fit more securely into the guiding groove. In constructing such a driveway, care must be taken to provide suitable drainage for storm water, else the rut will remain filled with water after each rain.

The construction of a guide-groove of this sort is less expensive than curbs, since it requires less material.

Sandusky, Ohio, Insures Repair of Sidewalks by Inspection

City dwellers commonly think of cement and concrete in terms of sidewalks, for it is their one daily first-hand contact with concrete. But they actually notice their sidewalks only when they are in bad condition.

Many sidewalks which were put down fifteen or twenty years ago are today in bad shape. Even some more recent jobs have sunk, been broken up, or have worn out due to poor construction. Generally, bad walks are the result of careless building, either improper foundation and grading or sloppy concrete. But the average citizen knows nothing of that and sometimes judges all concrete by what he sees in a few sidewalks.

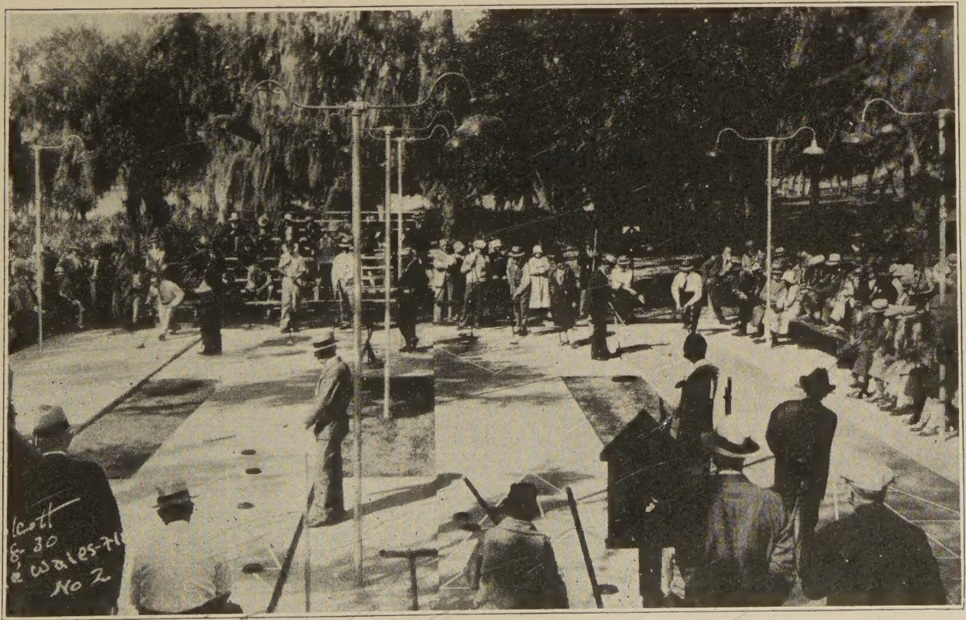
Such walks are unsightly, hard to clear of snow, and in wet weather they are often the abiding places of pools of water.

Some cities maintain sidewalk inspectors whose sole job is to inspect walks and see that they are repaired. Sandusky, Ohio, is an example. There, the sidewalk inspector reports regularly to the city commission on walks which should be repaired or replaced and locations where new walks are required.

Acting on his reports, the commission notifies the owner of the property abutting the defective or neglected walk. He is given fifteen days, from date of notice, to relay, repair or construct the walk in accordance with the city specifications. Where there is any question of the line or grade to be followed, the city engineer supplies the desired information.

If, at the end of the fifteen-day period the work has not been done, the department of public service does the job and the charge is placed against the owner.

Shuffleboard Tournament Held in Florida



The illustration shows play in progress during the Second Annual Florida Shuffleboard Association Tournament at Lake Wales, Florida, on February 18th, 19th and 20th, and gives an indication of the interest in this new sport. The development in Florida has been rapid. Other cities in the United States are building shuffleboard courts and the enthusiasm of the winter tourists in Florida is rapidly spreading to these localities. Besides Florida, courts are in use during the summer months in New Hampshire, Michigan and California. Once the game of shuffleboard is introduced in a community it immediately secures many enthusiastic supporters.

The Concrete Industry —25 YEARS AGO

IN an article on "Ornamental Cement Work," A. O. Tabor of Waterloo, Iowa, tells readers of the April, 1905, issue of CONCRETE about the methods of manufacture.

Of molds, he says in part, "The wooden mould is perhaps the best, for certain classes of work, such as hitching posts and other forms of plain work. Cast iron molds are advocated by some and for certain classes of work will doubtless prove satisfactory. The trouble with both wood and iron moulds is that they are not sufficiently porous to allow for the additional water during the curing process. The method that will prove most satisfactory is that of moulding the form desired in sand and then pouring the wet mix into this mould."

* * *

WHAT is apparently a comment by the editor of that day states: "In a contribution last month in regard to a new system of stone making, it was proposed to use a face of five parts of cement and one part of inexpensive ingredient for the face. It is the opinion of the writer that even though the cost of the cement were not to be considered such a rich mixture should not be used. It would be liable to hair cracks and also would not possess the life that a one to one or one to two mixture would.

"We have stated a great many times that no definite rule can be given. Also that equally good results can be obtained by using a smaller quantity of cement and a better mix. Machine mixing is in every way preferable to hand.

* * *

STRUCTURAL uses of concrete are reviewed in a two-page article in the CONCRETE of a quarter-century ago. Under "Reservoirs" it is stated that "Concrete has been used to a large extent for many years in their construction, but not until recently has concrete-steel been used for this purpose. The Louisville Water Company, Louisville, Ky., completed in 1900 a clear-water reservoir, 394 by 469 ft. and about 25 ft. high. The walls and columns were concrete, and the roof concrete-steel groined arches of about 19 ft. clear span.

Other paragraphs refer to current railroad roadbeds, dams, tunnels, cribwork, piers, abutments, etc.

* * *

"NEW uses for concrete are springing up every day. Experts in road making have for several years been figuring upon steel tracks for wagon roads, and these are now being used to some extent. For automobiles, concrete roadways would be far superior," declares a brief, illustrated item under "Concrete Automobile Road."

"In the figure above shown the motor vehicle is provided with guide wheels which prevent the tire from wearing upon the sides. It is believed that tracks of this kind are entirely practicable and will very shortly come into quite general use.

* * *

THE action of boiling saline solutions on cement compositions is reported upon by H. C. Stiefel in the April, 1905, issue of *Cement Age.* Tests slabs, 2 by 4 by 1 in. thick were used. Following alternate boiling and immersion in ice water over 43 hours changes in weight of from 4.6 to 5 per cent were shown. After six-hour boiling in calcium chloride no change in weight was shown.

Organizations

American Concrete Institute; Harvey Whipple, Secretary, 2970 West Grand Blvd., Detroit, Michigan.

American Concrete Pipe Association; M. W. Loving, Secretary, 33 W. Grand Ave., Chicago.

American Road Builders' Association; Chas. Upham, Engineer-Director, 914 National Press Building, Washington, D. C.

American Society of Civil Engineers; Geo. T. Seabury, Secretary, 33 W. Thirty-ninth St., New York City.

American Society for Testing Materials; C. L. Warwick, Secretary-Treasurer, Engineers' Club Building, 1315 Spruce St., Philadelphia, Pa.

Associated General Contractors of America; D. H. Sawyer, Secretary, 1150 Munsey Bldg., Washington, D. C.

Cast Stone Institute; L. A. Falco, Secretary, Chapel St. and Blatchley Ave., New Haven, Conn.

Building Officials Conference of America; Col. John W. Oehmann, Secretary, 1253 Lawrence St., N. E., Washington, D. C.

Cement Institute; Luther G. McConnell, General Manager, 11 East 44th St., New York City.

Concrete Reinforcing Steel Institute; M. A. Beeman, Secretary, Tribune Tower, Chicago.
Sixth annual meeting, March 31st to April 2nd, Bon-Air Vanderbilt Hotel, Augusta, Ga.

Haydite Manufacturers' Association; Dan F. Servey, Secretary-Treasurer, 203 Mutual Building, Kansas City, Mo.

Iowa Concrete Products Association; R. L. Gavin, Secretary-Treasurer, 1002 Hubbell Bldg., Des Moines, Iowa.

National Board of Fire Underwriters; W. E. Mallalieu, General Manager, 85 John St., New York City.

National Concrete Burial Vault Association; J. H. Stuart, Secretary-Treasurer, Bremen, Ohio.

National Concrete Products Association; Jack Franklin, Secretary, 425 East Water Street, Milwaukee, Wis.

National Crushed Stone Association; J. R. Boyd, Secretary, 751 Earle Building, Washington, D. C.

National Fire Protection Association; Franklin H. Wentworth, Secretary, 40 Central St., Boston, Mass.

National Lime Association; Norman G. Hough, Secretary and Manager, 927 Fifteenth St., N.W., Washington, D. C.

National Sand and Gravel Association; V. P. Ahearn, Executive Secretary, 432 Munsey Building, Washington, D. C.

National Slag Association; H. J. Love, Secretary-Treasurer, 937 Leader Building, Cleveland, Ohio.

Northwest Concrete Products Association; W. P. Hews, Secretary-Treasurer, Yakima, Wash.

Ohio Concrete Products Association; G. M. Friel, Secretary-Treasurer, 2284 North High St., Columbus, Ohio.

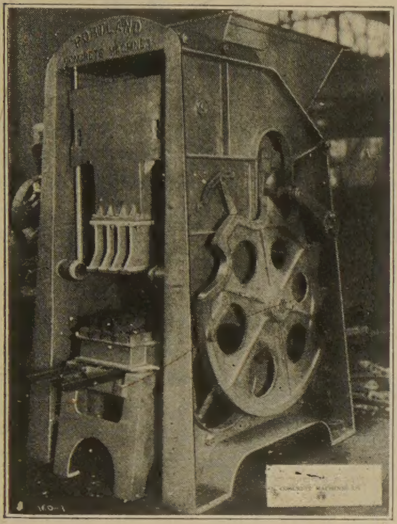
Portland Cement Association; William M. Kinney, General Manager, 33 W. Grand Ave., Chicago.

Rail Steel Bar Association; H. P. Bigler, Engineering Secretary, Builders' Building, 228 N. La Salle St., Chicago, Ill.

Wisconsin Concrete Products Association; Jack Franklin, Secretary-Treasurer, 3115 Plankinton Arcade, Milwaukee, Wisconsin.

New Equipment and Materials

New Portland Line of Concrete Products Machinery Announced



The Portland Concrete Machines Company, Chicago, Illinois, announces a complete new line of concrete products machinery for which the manufacturer claims high degrees of sturdiness of construction and automatic control of operations.

Heavy cast frames of great rigidity and strength have taken the place of riveted structural frames. Working parts are concentrated within the frame of the machine, where the full benefits of the rigid frame will come into play in maintaining true alignment. This, it is claimed, will insure a clean-cut product true to its designed dimensions.

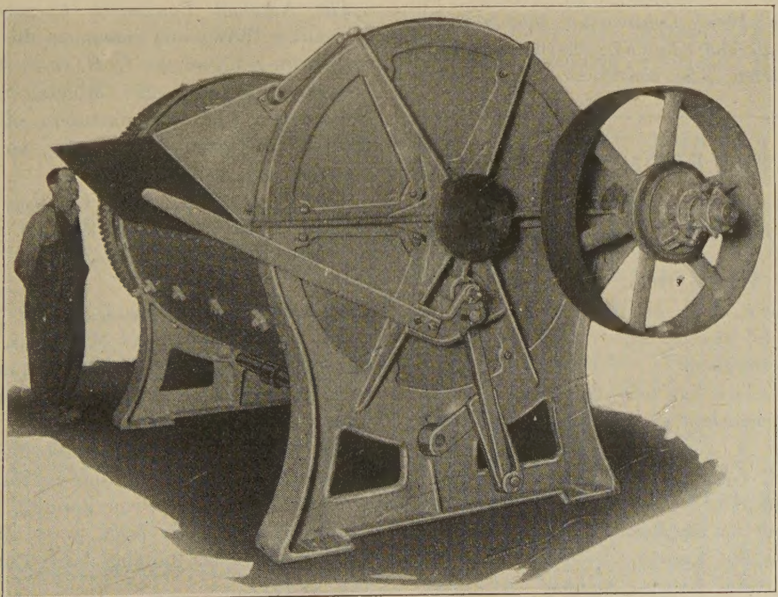
Power movements, with the exception of tamper lifts and drops, are located in the base of the machine frame, thereby keeping the center of gravity low and eliminating stresses ordinarily caused when operating parts are in the upper parts of machine frames.

Cast iron castings have been completely eliminated. Even the large machine-frame castings are made of special metal said to have more than twice the strength of ordinary castings.

Concrete mixers are made in seven sizes, from 5 to 90 cubic feet in capacity. The 60 and 90 cubic foot sizes are said to be a new departure for the concrete products machinery. In these mixers the entire inner surface of the mixing drum is lined with segments of high-strength metal that are easily renewable by an ordinary laborer. Two-piece liners protect the end castings. The blades are provided with a segmental liner which protects the entire surface and cutting edge of the blade frame. Timken and Hyatt roller bearings are used exclusively except in the small size mixer.

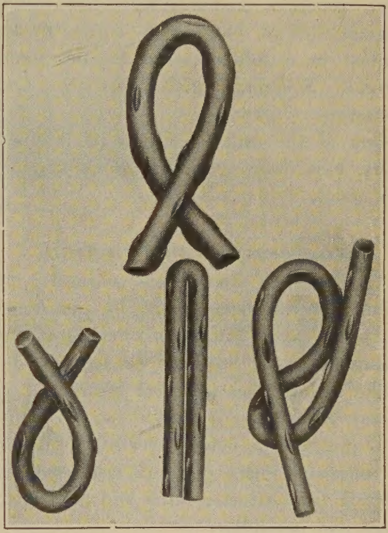
The new automatic block machines are made with capacities up to nine units a minute. These machines have been advanced to the full automatic stage, with the complete elimination of all hand levers and foot levers. Pallets are fed into the machine automatically through the use of pallet magazine stackers or racks.

The versatility of these automatic block machines may be seen from the fact that the six-a-minute machine makes either 2-core or 3-core standard size block in either 8, 10 or 12-inch wall widths, with air spaces of 33 1/3, 40 or 45 per cent. It will make either Samson or light-weight tile in 5 by 8 by 12-inch size, or manhole block, or partition block of 3, 4 or 6-inch wall width and 8 by 16-inch face. It will also make brick at the rate of 36 per minute. The manufacturers claim that this automatic machine will form the backbone of a complete concrete products manufacturing business.



Sweet's Process Gives New Ductility to Reinforcing Steel Bars

Increased ductility is the feature of reinforcing bars produced under a new process by the Sweet's Steel Company, Williamsport, Pa. Tests successfully performed on cold bars are said to exceed all reasonable specifications.



A full range of sizes of bars is produced in compliance with the Simplified practice Recommendation No. 26, proposed, approved and accepted by industry, under the auspices of the Division of Simplified Practice of the Department of Commerce.

Industrial Literature

Interlock Cribbing

Permacrete "Interlock" precast reinforced concrete cribbing is described and illustrated in literature published by the *Prendergast Company*, Marion, Ohio. Some of the features pointed out are that they may be laid vertical or staggered and that there is ample room for drainage.

Both open and closed face construction are shown.

About Makers of Equipment and Materials

Industrial Literature

Hunt Process Literature

"Curing Concrete by the Hunt Process" is a 12-page booklet published by *McEverlast, Inc.*, Los Angeles, Calif.

Standard specifications for curing are followed by an outline of application and action of the process, photographic illustrations showing its use, graphic test results, and a report by the testing and research laboratory of the California Highway Commission.

Masonry Truck Body

A dump body designed for use by concrete products manufacturers—the Commercial 3-Way hoist and body—is described in a folder issued by the *Commercial Shearing and Stamping Co.*, Youngstown, Ohio.

One of the unit's features is its flexibility, and numerous illustrations amplify this point.

Progress in Construction

An elaborate, comprehensive catalog of forms has just been issued by the *Blaw-Knox Company*, Pittsburgh, Pa. Excellent illustrations and explanatory legends describe various uses for steel forms and in a way constitute "a review of the country's progress in concrete construction."

Numerous types of work are covered, ranging from streets, curbs and gutters to piers and conduits.

On Johns-Manville Product

A revised and enlarged edition of *"Celite for Concrete"* is being distributed by the *Johns-Manville Corporation*, New York City.

The publication contains new material and photographs and supersedes a similar issue of May, 1929.

Clarkite for Increased Strength

A leaflet published by the *Bridgeport Stone Company*, Bridgeport, Conn., describes *Clarkite*, for coloring and waterproofing concrete block or transit mixed material. Tests made are claimed to have shown that Clarkite effects a decided increase in concrete strength within a short period.

Ransome Announces New Mast Plant

Bulletin 304, just published by the *Ransome Concrete Machinery Company*, of Dunellen, N. J., gives full details as to the design, construction and erection of its new heavy type steel mast, which can be used with any one of the three different types of concrete chuting plants most commonly used on construction work.

The sections of the mast are made in 22½ ft. lengths. The standard height sections can be erected to a height of 202½ feet.

Bulletin 304 also gives complete specifications and descriptions of Ransome chuting parts.

A new model 28-S standard building mixer is the subject of *Bulletin* 124.

British Cements

Illustrations of structures embodying the products of the *Cement Marketing Company, Ltd.*, London, England, comprise the bulk of the 24-page January issue of the "Ferrocrete and Snowcrete Bulletin."

Protective Products Handbook

A new "handbook and price list on Ceresit protective products used in building construction," has just been published by the *Ceresit Waterproofing Corporation*, Chicago, Ill.

Corkin Joint

The Colphalt Company of Ohio, Cleveland, Ohio, has published a six-page folder on its *Corkin* joint for use in highways.

It is pointed out that " 'Blow-ups' as the result of expansion can be prevented, spalling can be eliminated, cracking can be controlled."

Forms Folder

The Forms Department of the *Concrete Reinforcing Steel Institute*, Chicago, has published a four-page folder entitled *"The Logical Floor Construction for Schools, Hospitals and Churches,"* having reference to concrete joist construction.

NOTES FROM THE FIELD

Heltzel Sales Manager

The Heltzel Steel Form and Iron Company, Warren, Ohio, announces the appointment of B. M. Clark as manager of sales, to succeed W. J. Savage, who recently resigned.

Mr. Clark has held the position of assistant manager of sales for several years.

C. A. Clark Establishes Agency

Chas. A. Clark, until recently regional manager for the Portland Cement Association in the Kansas City region, and for nine years district engineer at Dallas, Texas, resigned on February 1st to become associated with *James Burrows* in establishing the firm of *Clark and Burrows, Inc.*, at Dallas. Mr. Burrows was formerly with the Geo. W. Smith Co., at that city.

The new firm has the North Texas sales agency for the National Equipment Corporation and several other manufacturers of contractors' and road builders equipment.

Savage Joins Brown Clutch

W. J. Savage, formerly vice-president and manager of sales of the *Heltzel Steel Form & Iron Company*, Warren, Ohio, has resigned and has become sales manager of the *Brown Clutch Company* of Sandusky, Ohio, manufacturers of contractor's hoists. His headquarters will be at the plant.

Autocar Trucks for Russia

The Amtorg Trading Company of New York have just bought 69 heavy-duty Autocar trucks for export to Russia, according to the announcement of H. M. Coale, vice president of the *Autocar Company*, Ardmore, Pa.

This order, which calls for immediate delivery, includes 20 model SCM chasses; 34 model SCHS and 15 model SCL, all of which are powered with 6-cylinder engines. Fifty-four of these units will be used for street construction and maintenance work in the city of Moscow and will be equipped with hydraulic dump bodies and pneumatic tires. Out of that group it is planned to use 34 trucks for hauling aggregate.

C. H. & E. Joins National Equipment

The National Equipment Corporation, Milwaukee, Wisconsin, announces the addition to its group of the *C. H. & E. Manufacturing Company*, 254 Mineral Street, Milwaukee, Wis., manufacturers of saw rigs, pumps, hoisting machinery, material elevators, and mortar mixers.

The C. H. & E. Mfg. Company was founded in Milwaukee, in 1909 by Frank F. Hase, president, and others.

Raymond Weeks Dies

The death of Raymond M. Weeks, a director of the National Building Units Corporation, New York City, occurred on March 11th.

Mr. Weeks was one of the first licensees to operate under the Straub patent. He was president of the Penn Building Block Co. of Philadelphia, prior to its merger with the National Building Units Corporation in 1929.